U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-247 186

EVALUATION OF SOLID WASTE BALING AND BALEFILLS

VOLUME II. TECHNICAL APPENDICES

RALPH STONE AND COMPANY, INCORPORATED

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY

1975

KEEP UP TO DATE

Between the time you ordered this report—which is only one of the hundreds of thousands in the NTIS information collection available to you—and the time you are reading this message, several *new* reports relevant to your interests probably have entered the collection.

Subscribe to the **Weekly Government Abstracts** series that will bring you summaries of new reports *as soon as they are received by NTIS* from the originators of the research. The WGA's are an NTIS weekly newsletter service covering the most recent research findings in 25 areas of industrial, technological, and sociological interest—invaluable information for executives and professionals who must keep up to date.

The executive and professional information service provided by NTIS in the **Weekly Government Abstracts** newsletters will give you thorough and comprehensive coverage of government-conducted or sponsored research activities. And you'll get this important information within two weeks of the time it's released by originating agencies.

WGA newsletters are computer produced and electronically photocomposed to slash the time gap between the release of a report and its availability. You can learn about technical innovations immediately—and use them in the most meaningful and productive ways possible for your organization. Please request NTIS-PR-205/PCW for more information.

The weekly newsletter series will keep you current. But *learn what you have missed in the past* by ordering a computer **NTISearch** of all the research reports in your area of interest, dating as far back as 1964, if you wish. Please request NTIS-PR-186/PCN for more information.

WRITE: Managing Editor
5285 Port Royal Road
Springfield, VA 22161

Keep Up To Date With SRIM

SRIM (Selected Research in Microfiche) provides you with regular, automatic distribution of the complete texts of NTIS research reports *only* in the subject areas you select. SRIM covers almost all Government research reports by subject area and/or the originating Federal or local government agency. You may subscribe by any category or subcategory of our WGA **(Weekly Government Abstracts)** or **Government Reports Announcements and Index** categories, or to the reports issued by a particular agency such as the Department of Defense, Federal Energy Administration, or Environmental Protection Agency. Other options that will give you greater selectivity are available on request.

The cost of SRIM service is only 45¢ domestic (60¢ foreign) for each complete microfiched report. Your SRIM service begins as soon as your order is received and processed and you will receive biweekly shipments thereafter. If you wish, your service will be backdated to furnish you microfiche of reports issued earlier.

Because of contractual arrangements with several Special Technology Groups, not all NTIS reports are distributed in the SRIM program. You will receive a notice in your microfiche shipments identifying the exceptionally priced reports not available through SRIM.

A deposit account with NTIS is required before this service can be initiated. If you have specific questions concerning this service, please call (703) 451-1558, or write NTIS, attention SRIM Product Manager.

This information product distributed by

NTIS U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

BIBLIOGRAPHIC DATA SHEET

1. Report No.

2.

3. Recipient's Accession No.

4. Title and Subtitle
Evaluation of solid waste baling and balefills--volume II: technical appendices

5. Report Date
1975

6.

7. Author(s)
Ralph Stone

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Ralph Stone and Company, Inc.
10954 Santa Monica Boulevard
Los Angeles, California 90025

10. Project/Task/Work Unit No.

11. Contract/Grant No.
68-03-0332

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
Office of Solid Waste Management Programs
Washington, D. C. 20460

13. Type of Report & Period Covered
Final

14.

15. Supplementary Notes

16. Abstracts

This final report presents the results of a one-year evaluation of a solid waste high-density baling plant, transportation and associated sanitary landfill operation of the American Hoist and Derrick Company in St. Paul, Minnesota. The work program consisted of four stages: (1) a five-day intensive monitoring program of the baling plant and bale transportation operations; (2) cost analysis during two years of plant operation; (3) a 12-month period of monitoring a bale test cell constructed at the St. Paul bale landfill; and (4) a nine-month period of monitoring the bale sanitary landfill operation. Test cell monitoring included analyzing leachate and gas samples, recording and analyzing temperature trends, and settlement/expansion. Landfill monitoring included time and motion studies, fly emergence studies, and odor, litter, dust, and vectors evaluation. Comparisons were made between the bale landfill and normal environmental conditions. The feasibility of solid waste baling plants was evaluated, and compared to milling and combined solid waste baling and milling systems.

17. Key Words and Document Analysis. 17a. Descriptors

Baling, Waste, Leaching, Settling, Transportation

17b. Identifiers/Open-Ended Terms
St. Paul, Minnesota Baling Plant
Municipal Solid Waste
Solid Waste baling plant
Bale Landfilling

17c. COSATI Field/Group

PRICES SUBJECT TO CHANGE

18. Availability Statement

19. Security Class (This Report)
UNCLASSIFIED

20. Security Class (This Page)
UNCLASSIFIED

21. No. of Pages
161

22. Price
6.75-2.25

i.

FORM NTIS-35 (REV. 10-73) ENDORSED BY ANSI AND UNESCO. THIS FORM MAY BE REPRODUCED USCOMM-DC 8265-P74

TABLE OF CONTENTS

		Page
TABLE OF CONTENTS		iii
LIST OF FIGURES		iii
LIST OF PHOTOGRAPHS		vii
LIST OF TABLES		v
APPENDIX A:	FIVE-DAY BALING PLANT AND TRANSPORT MONITORING DATA FORMS	1
APPENDIX B:	AMERICAN HOIST AND DERRICK COMPANY BALING PLANT AND OPERATIONS DATA FORMS	23
APPENDIX C:	BALING PLANT EQUIPMENT DESCRIPTION	37
APPENDIX D:	BALING PLANT AND BALEFILL DETAILS	57
APPENDIX E:	BALING PLANT SYSTEM AND HUMAN PERFORMANCE ANALYSIS	72
APPENDIX F:	YEAR-LONG SYSTEM MONITORING DATA FORMS	117
APPENDIX G:	LANDFILL OBSERVATIONS AND TEST-CELL MONITORING DATA	133

LIST OF FIGURES

Figure No.		
D-1	BALING PLANT FLOOR PLAN	58
D-2	BALING PLANT CONTROL PANEL SCHEMATIC	59
D-3	CONTROL PANEL - MIDDLE SECTION	60
D-4	CONTROL PANEL - RIGHT SIDE	61
D-5	CONTROL PANEL - LEFT SIDE	62
D-6	BALER DETAILS	63
D-7	CONVEYOR DETAILS	64
D-8	LOADING DOCK SCHEMATIC	65
D-9	BALING PLANT TRANSPORT VEHICLE	66
D-10	BALE TRANSPORT TRUCK ROUTE TO BALEFILL	67
D-11	BALEFILL TOPOGRAPHY AND TEST CELL LOCATION	68
E-1	STATE UTILIZATION BY MACHINE	75
E-2	GANTT CHART OF MACHINES	78

PB 247 186

EVALUATION OF SOLID WASTE BALING AND BALEFILLS

VOLUME II: TECHNICAL APPENDICES

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

PRICES SUBJECT TO CHANGE

338062

This report as submitted by the grantee or contractor has not been technically reviewed by the U.S. Environmental Protection Agency (EPA). Publication does not signify that the contents necessarily reflect the views and policies of EPA, nor does mention of commercial products constitute endorsement or recommendation for use by the U.S. Government.

An environmental protection publication (SW-111c.2) in the solid waste management series.

LIST OF FIGURES (CONT.)

Figure No.		Page
E-3	BALING PLANT GATEMAN ACTIVITY NETWORK	80
E-4	BALING PLANT LOADER ACTIVITY NETWORK	81
E-5	BALING PLANT CONVEYOR ACTIVITY NETWORK	82
E-6	BALING PLANT SCALE ACTIVITY NETWORK	83
E-7	BALING PLANT BALER ACTIVITY NETWORK	84
E-8	BALING PLANT PUSHER ACTIVITY NETWORK	85
E-9	BALING PLANT TRANSPORT ACTIVITY NETWORK	86
E-10	BALEFILL FORKLIFT ACTIVITY NETWORK	87
E-11	GATEMAN MOVEMENTS DURING FEE COLLECTION	97
E-12	DAILY DISTRIBUTION OF WASTE VEHICLE ARRIVALS	98
E-13	WEEKLY DISTRIBUTION OF VEHICLE ARRIVALS	99
E-14	DISTRIBUTION OF VEHICLE ARRIVALS BY VEHICLE SIZE	100
E-15	LOADER MOVEMENT FOR PLACING WASTE ON CONVEYOR	105
E-16	CONTROL TOWER LAYOUT	108
E-17	BALE TRANSPORT TRUCK LOAD-UNLOAD POSITION LAYOUTS	112
E-18	CORRUGATED SORTER WORK STATIONS	114
E-19	MANPOWER UTILIZATION	116
G-1	BALE EXPANSION - 9/20/73	139
G-2	BALE EXPANSION - 9/21/73	140
G-3	BALE EXPANSION - 9/24/73	141
G-4	BALE EXPANSION - 9/25/73	142
G-5	BALE EXPANSION - 9/26/73	143
G-6	FLY EMERGENCE TRAPS	147

LIST OF TABLES

Table No.		Page
A-1	BALING PLANT ACTIVITY CHART 1-A	2
A-2	BALING PLANT ACTIVITY CHART 1-B	3
A-3	TRANSPORT NET ACTIVITY CHART II	4
A-4	LANDFILL ACTIVITY CHART III	5
A-5	DAILY BALE COUNT	6
A-6	TENTH BALE DATA	7
A-7	PLANT MONITORING GATE ATTENDANT FORM	8
A-8	INCOMING WASTE DENSITY	9
A-9	SORTING DATA FORM	10
A-10	BALE CORE SAMPLE DATA	11
A-11	PRESSED WASTEWATER SAMPLES	12
A-12	EQUIPMENT MAINTENANCE LOG	13
A-13	ACCIDENT REPORT	14
A-14	WEEKLY LABOR REPORT	15
A-15	WEEKLY STATIONARY EQUIPMENT COST	16
A-16	WEEKLY MOBILE EQUIPMENT COST	17
A-17	MONTHLY OPERATIONS SUMMARY	18
A-18	CAPITAL INVESTMENT REPORT	19
A-19	TOTAL COST SUMMARY FOR PLANT	20
A-20	TOTAL COST SUMMARY FOR TRANSPORTATION	21
A-21	TOTAL COST SUMMARY FOR BALEFILL	22
B-1	OFFICE EMPLOYEE TIME CARD	24
B-2	PLANT EMPLOYEE TIME CARD	25
B-3	MAINTENANCE WORK ORDER	26
B-4	INTER-PLANT WORK ORDER	27
B-5	GATEMAN CASH RECEIPT	28
B-6	TRUCK DRIVER DAILY LOG	29
B-7	PURCHASE REQUISITION	30

LIST OF TABLES (Cont.)

Table No.		Page
B-8	SUPPLEMENTARY RECORD OF OCCUPATIONAL INJURIES AND ILLNESSES	31
B-9	INVOICE FORM	35
B-10	PREVENTATIVE MAINTENANCE PROCEDURE FORM	36
C-1	EXISTING 137-SECOND CYCLE BALER DESCRIPTION	38
C-2	90-SECOND CYCLE BALER DESCRIPTION	43
C-3	EQUIPMENT DATA FORM: FORKLIFT	48
C-4	EQUIPMENT DATA FORM: BOBCAT LOADER (ON LOAN)	49
C-5	EQUIPMENT DATA FORM: BOBCAT LOADER (IN REPAIR)	50
C-6	EQUIPMENT DATA FORM: ELECTRIC SWEEPER	51
C-7	EQUIPMENT DATA FORM: LOADER	52
C-8	EQUIPMENT DATA FORM: GENERATOR	53
C-9	RECOMMENDED SPARE PARTS LIST	54
E-1	MACHINE INTERFERENCE BY MACHINE	77
E-2	PROCESS SEQUENCE ON UNIT OF SOLID WASTE BALED	88
E-3	REDUCED BALED SOLID WASTE NETWORK	89
E-4	MOVEMENT OF STANDARD TIMES FOR GATEMAN AND LOADER	90
E-5	MOVEMENT OF STANDARD TIMES FOR CONVEYOR AND SCALE	91
E-6	MOVEMENT OF STANDARD TIMES FOR BALER AND PUSHER	92
E-7	MOVEMENT OF STANDARD TIMES FOR TRANSPORTS	93
E-8	GATEMAN TASKS	96
E-9	LOADER OPERATOR TASKS	102
E-10	CONTROL TOWER OPERATOR TASKS	106
E-11	TRUCK DRIVER TASKS	109
E-12	TRANSPORT VEHICLE RIGGING TIME	111
E-13	SORTER TASKS	113
F-1	FIELD ACTIVITIES LOG	118
F-2	WEEKLY DATA REPORT SUMMARY SHEET	119
F-3	LANDFILL OPERATION RECORD	120
F-4	LANDFILL ENVIRONMENTAL RECORD	122

LIST OF TABLES (Cont.)

Table No.		Page
F-5	TOTAL COST SUMMARY FOR PLANT	124
F-6	TOTAL COST SUMMARY FOR TRANSPORTATION	125
F-7	TOTAL COST SUMMARY FOR LANDFILL	126
F-8	PERIOD BALE PLANT STATIONARY EQUIPMENT COST	127
F-9	PERIOD BALE PLANT MOBILE EQUIPMENT COST	128
F-10	PERIOD TRANSPORT EQUIPMENT COST	129
F-11	PERIOD LANDFILL EQUIPMENT COST	130
F-12	PERIOD OPERATIONS SUMMARY	131
F-13	PERIOD LABOR REPORT	132
G-1	TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/20/73	134
G-2	TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/21/73	135
G-3	TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/24/73	136
G-4	TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/25/73	137
G-5	TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/26/73	138
G-6	BALE SPACING RESULTS	144
G-7	LITTER COUNT RESULTS	146
G-8	FLYING INSECTS COLLECTED IN THE BALEFILL FLY EMERGENCE TRAPS	149
G-9	LAND DISPOSAL EVALUATION SHEET	150

LIST OF PHOTOGRAPHS

Photograph No.		
D-1	BALE PLACEMENT IN HORIZONTAL TIERS	69
D-2	LANDFILL BALE HANDLING EQUIPMENT	70
D-3	COVER SOIL LOADER	71
G-1	FLY EMERGENCE TRAPS	148

APPENDIX A

FIVE-DAY BALING PLANT AND TRANSPORT MONITORING FORMS

TABLE A-1
BALING PLANT ACTIVITY CHART 1-A

	Gate						Loader										Conv		
	idle	fee	volume	direct dmp	sort	misc	idle	sort	maint	misc	carry	unload	return	travel	mix	load	F run	S run	
.25																			.25
.50																			.50
.75																			.75
1.00																			1.00
1.25																			1.25
1.50																			1.50
1.75																			1.75
2.00																			2.00
2.25																			2.25
2.50																			2.50
2.75																			2.75
3.00																			3.00
3.25																			3.25

Continued to 5.25

TABLE A-2
BALING PLANT ACTIVITY CHART 1-B

	Conv		Scale						Baler								
	F run	S run	idle	operate	misc	maint	load	dump	door close	gather	tamp	compact	eject	push #1	push #2	idle	
.25																	.25
.50																	.50
.75																	.75
1.00																	1.00
1.25																	1.25
1.50																	1.50
1.75																	1.75
2.00																	2.00
2.25																	2.25
2.50																	2.50
2.75																	2.75
3.00																	3.00
3.25																	3.25

Continued to 5.25

TABLE A-3

TRANSPORT NET ACTIVITY CHART II

Truck: License # Vehicle #

Conditions: __/__/__ Date __:__ Time ______ Observer weather (circle): clear; fog; light rain; heavy rain; windy Traffic conditions:	Symbols Route: R1 = mi; R2 = mi Maintenance: 1 = suspension, wheels/2 = cooling, exhaust/3 = electrical /4 = fuel /5 = rigging/6 = steering/7 = accident Bales: (N) = N bales

Load No	Load Time		Transport			Unload Time		Return			Maintenance	
	Start ˋ	< End	< Start	Mileage/ # Bales	End ˋ	Start ˋ	ˊ End	< Start	Mileage	End ˋ	Start	End
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												

Details: __/__/__ Date __:__ Time ______ Observer

Footnotes/Comments: ____________________

TABLE A-4
LANDFILL ACTIVITY CHART III

LIFT								LOADER								
Idle	Load	Carry	Unload	Posi-tion	Return	Travel	Hand Work	Idle	Load	Carry	Dump	Grade	Com-pact.	Return	Exca-vate	Travel

1 = talk 2 = walk 3 = personal 4 = gas 5 = maint. 6 = unrig 7 = misc. 8 = wait for truck
9 = sweep off truck 10 = move truck

Date: ________________

TABLE A-5
DAILY BALE COUNT

No.	Weight Lbs.	No.	Weight Lbs.	No.	Weight Lbs.	No.	Weight Lbs.
1		42		82		123	
2		43		83		124	
3		44		84		125	
4		45		85		TIME	
5		46		86		126	
6		47		87		127	
7		48		88		128	
8		49		89		129	
9		50		90		130	
10		TIME		91		131	
11		51		92		132	
12		52		93		133	
13		53		94		134	
14		54		95		135	
15		55		96		136	
16		56		97		137	
17		57		98		138	
18		58		99		139	
19		59		100		140	
20		60		TIME		141	
21		61		101		142	
22		62		102		143	
23		63		103		144	
24		64		104		145	
25		65		105		146	
TIME		66		106		147	
26		67		107		148	
27		68		108		149	
28		69		109		150	
29		70		110		TIME	
30		71		111		151	
31		72		112		152	
32		73		113		153	
33		74		114		154	
34		75		115		155	
35		TIME		116		156	
36		76		117		157	
37		77		118		158	
38		78		119		159	
39		79		120		160	
40		80		121		161	
41		81		122		162	

TABLE A-6
TENTH BALE DATA

Time of Day												
Bale Prod. No.												
Time to Produce												
Ram Pressure												
BALE DIMENSIONS (inches)	Ten Minutes	H.	Max									
			Min									
		W.	Max									
			Min									
		L.	Max									
			Min									
	One Hour	H.	Max									
			Min									
		W.	Max									
			Min									
		L.	Max									
			Min									
	24-Hour	H.	Max									
			Min									
		W.	Max									
			Min									
		L.	Max									
			Min									
	One Week	H.	Max									
			Min									
		W.	Max									
			Min									
		L.	Max									
			Min									

L - Length W - Width H - Height

Comments

TABLE A-7
PLANT MONITORING
GATE ATTENDANT FORM

Arrival Time	Owner of Vehicle	License Number	Vehicle Size Cu Yds	Volume of Solid Waste Cu Yds	Fee $	Type of Waste Load			Other	Comments
						Residential	Industrial	Commercial		

TABLE A-8
INCOMING WASTE DENSITY

Date	Time of Day	Sample Wt. Lbs.	Sample Vol. Cu Yds.	Sample Density Lbs/Cu Yd	Comments

TABLE A-9
SORTING DATA FORM

Time of Day	Paper	Wood	Metal	Textile	Plastic	Rubber and Leather	Food Waste	Glass and Ceramic	Garden Waste	Rock and Dirt	Smalls 1"→1/8"	Fines 1/8"	Total
Morning													
Subtotal													
Afternoon													
Subtotal													
Tot. Wt.													
Tot. (%)													

EPA Contract No. 68-03-0332/American Hoist Company

Page________ of______________

By________________Checked___

TABLE A-10
BALE CORE SAMPLE DATA

	Time of Day	Bale Production Number	Core Depth (In.)	Comments
Day One				
Day Two				
Day Three				
Day Four				
Day Five				

NOTE: One sample from each of the six faces to be placed in one container.

EPA Contract No. 68-03-0332/American Hoist Company

Date__________Page______of______

By______________Checked______

TABLE A-11

PRESSED WASTEWATER SAMPLES

Day	Sample No.	Time of Day	Total Volume Produced Liters	Production Number of Last Bale	Comments
1	1S1				
	1S2				
2	2S1				
	2S2				
3	3S1				
	3S2				
4	4S1				
	4S2				
5	5S1				
	5S2				

NOTE: Samples should be approximately one liter.

TABLE A-12
EQUIPMENT MAINTENANCE LOG

Date started____________ Date ended____________
Time started____________ Time ended____________
Machine name____________________ Sheet # ____________
No.__________ Model__________ Mfrs.____________

	Downtime		Action Taken	
Date	Start	End	Problem, Labor, Parts, Special Tools	Signature

TABLE A-13
EPA CONTRACT NO. 68-03-0332/AMERICAN HOIST COMPANY
ACCIDENT REPORT

Date ______________ Person to contact ______________________________

Employee's name ________________________ Date of accident ______ Time ________

Job description ____

Type of injury ____

Effect on employee ____
(permanent/partial/temporary) ____

Lost time _______________________ Therapy ______________________________
____

Initial cost _____________________ Therapy cost __________________________
____

Reason for accident ____
____
____
____
____
____
____
____

Conditions at time of accident (time, weather, fatigue, equipment)
____
____
____
____
____
____

Signature of person completing form ______________________________

TABLE A-14
WEEKLY LABOR REPORT

Employee Name	Shift 1 2	DAY 1 Job/Hours	DAY 2 Job/Hours	DAY 3 Job/Hours	DAY 4 Job/Hours	DAY 5 Job/Hours	DAY 6 Job/Hours	Individual Totals
				PLANT				
TRANSPORTATION								
LANDFILL								

Job Legend: Lo Landfill Operations D – Driving to and from site PH – Plant Handling (sorting, charging)
PR – Plant Receiving S – Supervision RM – Repairs and Maintenance (include part-time repair men

TABLE A-15
WEEKLY STATIONARY EQUIPMENT COST

Equipment Identification						
DAY 1	Maint. Repair Total					
DAY 2	Maint. Repair Total					
DAY 3	Maint. Repair Total					
DAY 4	Maint. Repair Total					
DAY 5	Maint. Repair Total					
DAY 6	Maint. Repair Total					

TABLE A-16
WEEKLY MOBILE EQUIPMENT COST

Vehicle License No.					Comments
DAY 1	M + R* Fuel Oil Total				Daily Total
DAY 2	M + R* Fuel Oil Total				Daily Total
DAY 3	M + R* Fuel Oil Total				Daily Total
DAY 4	M + R* Fuel Oil Total				Daily Total
DAY 5	M + R* Fuel Oil Total				Daily Total
DAY 6	M + R* Fuel Oil Total				Daily Total
Individual Totals					

* M + R denotes Maintenance and Repair

TABLE A-17
MONTHLY OPERATIONS SUMMARY

LABOR COST					
	Week 1	Week 2	Week 3	Week 4	Week 5
Plant Transport Landfill Total					
EQUIPMENT MAINTENANCE					
Mobile Stationary Total					
UTILITIES COST					
Gas Electric Water Telephone Other ______ Total					
MISCELLANEOUS COST					
Identify ______ ______ ______ ______ Total					
FIXED COSTS					
Plant Transport Landfill Total					
Subtotals					

TABLE A-18
CAPITAL INVESTMENT REPORT

Description	Size, Amount etc.	Date Put In Use	Est. Total Life	Cost New	Depreciation	
					Yearly	Monthly
PLANT:						
Land					X	X
Surveys						
Preparation						
Roads						
Buildings						
Baler						
Scales						
Bins						
Motors						
Pumps						
Conveyor						
Loader						
Fork Lift						
Control Unit						
Other__________						
TOTAL						
TRANSPORT:						
1						
2						
Trucks 3						
4						
5						
Other__________						
TOTAL						
LANDFILL:						
Land						
Surveys						
Preparation						
Roads						
Fork Lift						
Loader						
Generator						
Other__________						
TOTAL						
TOTALS	X	X	X			

TABLE A-19
TOTAL COST SUMMARY FOR PLANT

Item	For This Period	Budget This Period	Year To Date	Budget Year to Date
Tons of Waste Received				
Number of Bales Produced				
Total Operating Cost				
Total Financing Cost				
Total Cost				
TOTAL COST PER TON				
REVENUES:				
Private Collectors				
Public Collectors				
Salvage:				
Cardboard				
Metals				
OTHER				
TOTAL REVENUES				
TOTAL REVENUES PER TON				
NET COST (PROFIT)				
NET COST PER TON				
NET COST/TON/DAY				

TABLE A-20
TOTAL COST SUMMARY FOR TRANSPORTATION

Item	For This Period	Budget This Period	Year To Date	Budget Year to Date
Tons of Waste Hauled				
No. of Bales Hauled				
Total Operating Cost				
Total Financing Cost				
Total Cost				
Operating Cost Per Ton				
Financing Cost Per Ton				
Total Cost Per Ton				
Total Cost Per Ton Per Day				

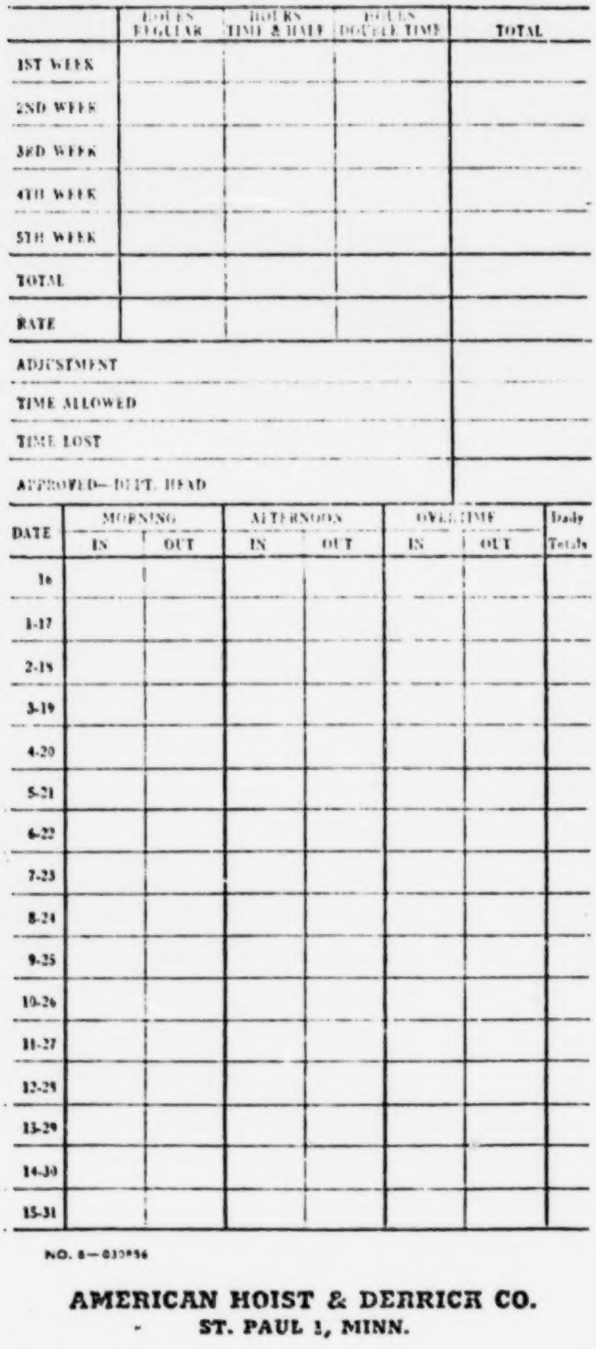
TABLE A-21
TOTAL COST SUMMARY FOR BALEFILL

Item	For This Period	Budget This Period	Year To Date	Budget Year to Date
Tons of Waste Received				
No. of Bales Received				
Total Operating Cost				
Total Financing Cost				
Total Cost				
Operating Cost Per Ton				
Financing Cost Per Ton				
Total Cost Per Ton				
Total Cost Per Ton Per Day				

APPENDIX B

AMERICAN HOIST AND DERRICK COMPANY BALING PLANT AND OPERATIONS DATA FORMS

TABLE B-1
OFFICE EMPLOYEE
TIME CARD



	HOURS REGULAR	HOURS TIME & HALF	HOURS DOUBLE TIME	TOTAL
1ST WEEK				
2ND WEEK				
3RD WEEK				
4TH WEEK				
5TH WEEK				
TOTAL				
RATE				
ADJUSTMENT				
TIME ALLOWED				
TIME LOST				
APPROVED—DEPT. HEAD				

DATE	MORNING		AFTERNOON		OVERTIME		Daily
	IN	OUT	IN	OUT	IN	OUT	Totals
16							
1-17							
2-18							
3-19							
4-20							
5-21							
6-22							
7-23							
8-24							
9-25							
10-26							
11-27							
12-28							
13-29							
14-30							
15-31							

NO. 8—033956

AMERICAN HOIST & DERRICK CO.
ST. PAUL 1, MINN.

TABLE B-2
PLANT EMPLOYEE TIME CARD

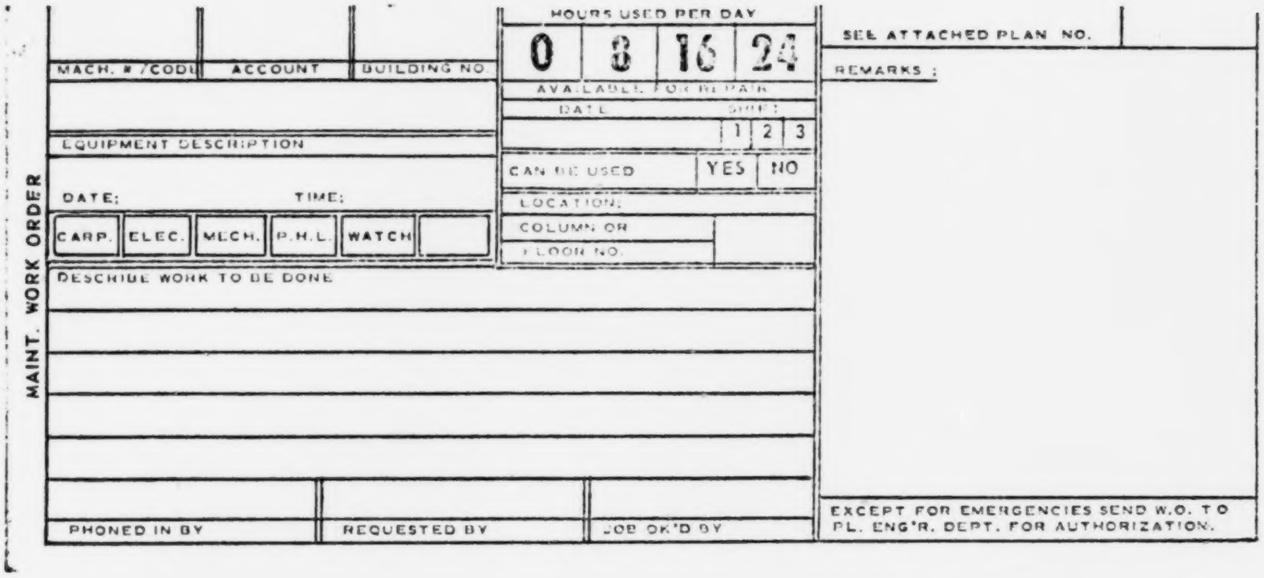
AMERICAN HOIST & DERRICK CO.

SAT.				
FRI.				
THU.				
WED.				
TUE.				
MON.				
		123	456	789

ADJ__________
SFT___HRS______AMT______
SFT___HRS______AMT______
SFT___HRS______AMT______
SFT___HRS______AMT______
SFT___HRS______AMT______
SFT___HRS______AMT______
TOTAL ______ ______
FEDERAL TAX STATE TAX
________ ________

Simplex 8—204066

TABLE B-3
MAINTENANCE WORK ORDER



MAINT. WORK ORDER

MACH. #/CODE
ACCOUNT
BUILDING NO.
EQUIPMENT DESCRIPTION
DATE:
TIME:
☐ CARP. ☐ ELEC. ☐ MECH. ☐ P.H.L. ☐ WATCH ☐

HOURS USED PER DAY
0 | 8 | 16 | 24
AVAILABLE FOR REPAIR
DATE
SHIFT
☐ 1 ☐ 2 ☐ 3
CAN BE USED ☐ YES ☐ NO
LOCATION:
COLUMN OR
FLOOR NO.

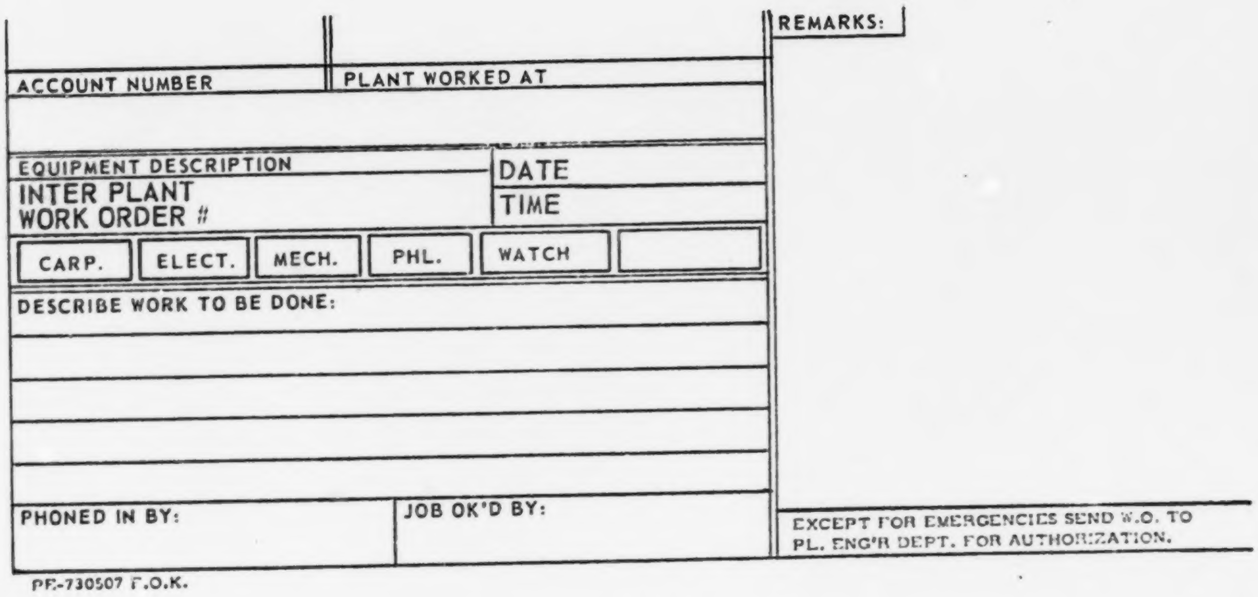
DESCRIBE WORK TO BE DONE

PHONED IN BY
REQUESTED BY
JOB OK'D BY

SEE ATTACHED PLAN NO.
REMARKS :

EXCEPT FOR EMERGENCIES SEND W.O. TO PL. ENG'R. DEPT. FOR AUTHORIZATION.

TABLE B-4
INTER-PLANT WORK ORDER



ACCOUNT NUMBER

PLANT WORKED AT

EQUIPMENT DESCRIPTION

INTER PLANT WORK ORDER #

DATE

TIME

CARP. ELECT. MECH. PHL. WATCH

DESCRIBE WORK TO BE DONE:

PHONED IN BY:

JOB OK'D BY:

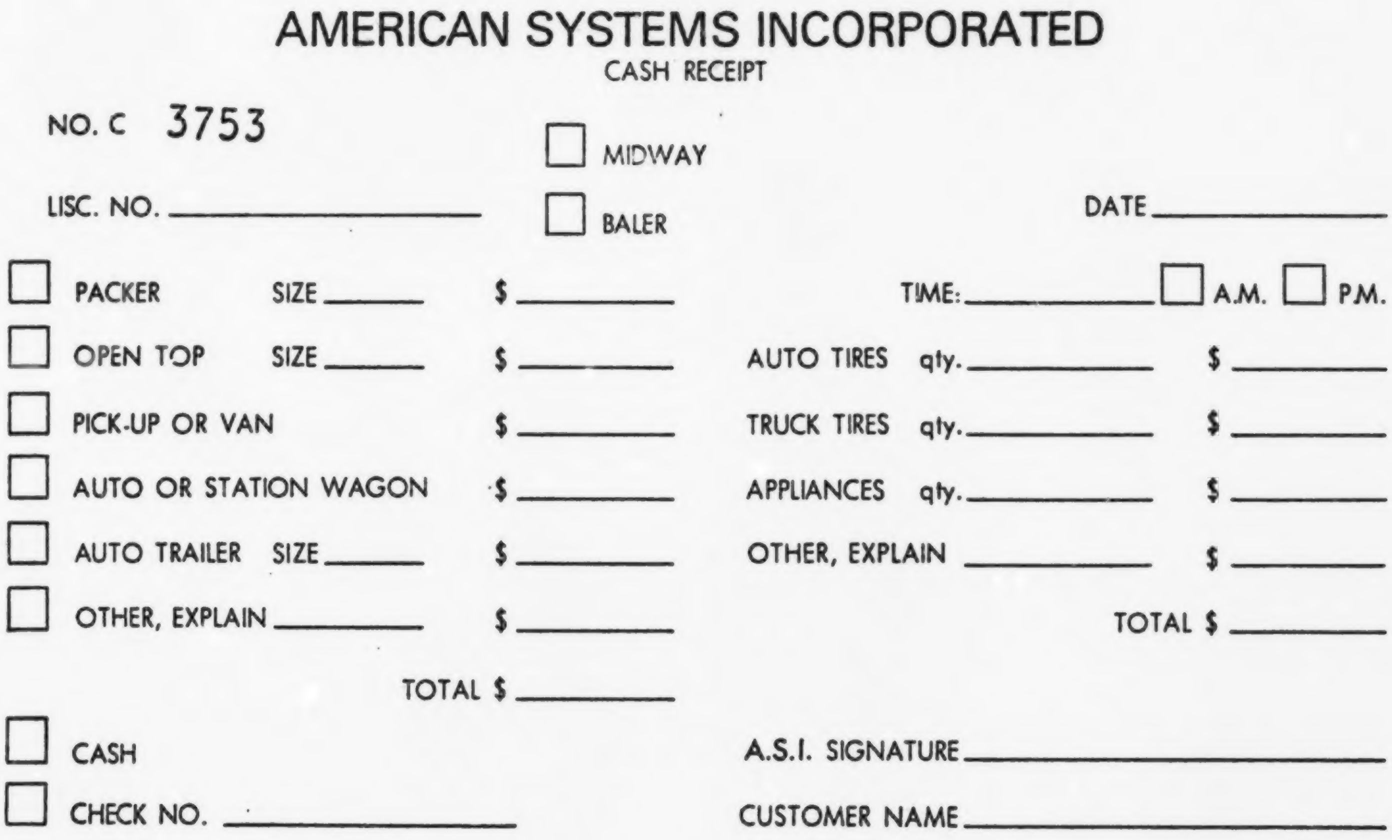
REMARKS:

EXCEPT FOR EMERGENCIES SEND W.O. TO PL. ENG'R DEPT. FOR AUTHORIZATION.

PE-730507 F.O.K.

TABLE B-5

GATEMAN CASH RECEIPT



AMERICAN SYSTEMS INCORPORATED

CASH RECEIPT

NO. C 3753

☐ MIDWAY

☐ BALER

LISC. NO. ____________________

DATE ____________________

TIME: ____________ ☐ A.M. ☐ P.M.

☐ PACKER SIZE ______ $ __________

☐ OPEN TOP SIZE ______ $ __________

☐ PICK-UP OR VAN $ __________

☐ AUTO OR STATION WAGON $ __________

☐ AUTO TRAILER SIZE ______ $ __________

☐ OTHER, EXPLAIN __________ $ __________

TOTAL $ __________

AUTO TIRES qty. __________ $ __________

TRUCK TIRES qty. __________ $ __________

APPLIANCES qty. __________ $ __________

OTHER, EXPLAIN __________ $ __________

TOTAL $ __________

☐ CASH

☐ CHECK NO. ____________________

A.S.I. SIGNATURE ____________________

CUSTOMER NAME ____________________

TABLE B-6

TRUCK DRIVER DAILY LOG

Date________________ Truck No.________________________

Driver______________________

Time Start_________Time Fin.__________Lunch from______to______Total Hr._____

List below every step: time started, finished; weight; unloading time; delays and reasons

Time					
From	To	Explanation (loading, unloading, etc.)	Trlr. No.	Load	Min.

TABLE B-7

PURCHASE REQUISITION

PAGE OF

P. O. NO.

REQUISITION DATE

P. O. DATE

CHARGE TO ACCT.

DATE REQUIRED

VENDOR:

TERMS

SHIPPING POINT

ROUTING

F O B POINT

DELIVER TO	QTY	ITEMS	PRICE

SEND YELLOW ORIGINAL TO PURCHASING DEPARTMENT

SIGNED

APPROVED

TABLE B - 8

AMERICAN

AMERICAN HOIST
& DERRICK COMPANY
SUPERVISOR'S 48 HOUR REPORT OF AN INJURY

Date of Report ____________

Indicate Type of Injury:
☐ Disabling Injury ☐ Medical
☐ Unclassified

OSHA No. 101
Case or File No. ____________

Supplementary Record of Occupational Injuries and Illnesses

EMPLOYER

1. Name ____________
2. Mail address ____________ (No. and street) ____________ (City or town) ____________ (State)
3. Location, if different from mail address ____________

INJURED OR ILL EMPLOYEE

4. Name ____________ (First name) ____________ (Middle name) ____________ (Last name) Social Security No. ____________
5. Home address ____________ (No. and street) ____________ (City or town) ____________ (State)
6. Age ______ 7. Sex: (check one) ☐ Male ☐ Female
8. Occupation ____________
   Enter regular job title, *not* the specific activity he was performing at time of injury.
9. Department ____________
   Enter name of department or division in which the injured person is regularly employed, even though he may have been temporarily working in another department at the time of injury.

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure ____________ (No. and street) ____________ (City or town) ____________ (State)
    If accident or exposure occurred on employer's premises, give address of plant or establishment in which it occurred. Do not indicate departmenr or division within the plant or establishment. If accident occurred outside employer's premises at an identifiable address, give that address. If it occurred on a public highway or at any other place which cannot be identified by number and street, please provide place references locating the place of injury as accurately as possible.
11. Was place of accident or exposure on employer's premises? ☐ Yes ☐ No
12. What was the employee doing when injured? (Use separate sheets for explanation)
    Be specific. If he was using tools or equipment or handling material, name them and tell what he was doing with them.
    ____
    ____

TABLE B-8 (Cont.)

13. How did the accident occur? (Use separate sheets for explanation)
Describe fully the events which resulted in the injury or occupational illness. Tell what happened and how it happened. Name any objects or substances involved and tell how they were involved. Give full details on all factors which led or contributed to the accident.

____

____

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

14. Describe the injury or illness in detail and indicate the part of body affected.*
That is, amputation of right index finger at second joint; fracture of ribs; lead poisoning; dermatitis of left hand, etc.

____

15. Name the object or substance which directly injured the employee.
For example, the machine or thing he struck against or which struck him; the vapor or poison he inhaled or swallowed; the chemical or radiation which irritated his skin; or in cases of strains, hernias, etc., the thing he was lifting, pulling, etc.

____

____

16. Date of injury or initial diagnosis of occupational illness: ______________ Hour: ________

17. Did employee die? ☐ Yes ☐ No Disability? ☐ Yes ☐ No If yes: ☐ Permanent ☐ Temporary ☐ Light Duty

OTHER

18. Name and address of physician ______________________________

19. If hospitalized, name and address of hospital ______________________________

____

Date of report ________ Prepared by ______________ Official position ______________

*Provide details on medical treatments (sutures, x-rays, types of injections, casts, etc.)

(COMPLETE THE REVERSE SIDE)

______________ Supv. ______________ Dept. Supt. ______________ Plant Manager

Form No. IR 201 Rev. 6/72

TABLE B-8 (Cont.)

CAUSE: Mark Basic Cause ☒ (1) Mark Contributing Cause, if any 🄾 (2)

UNSAFE ACTS

1. ☐ Operating Without Authority
2. ☐ Operating at Unsafe Speed
3. ☐ Making Safety Devices Inoperative
4. ☐ Using unsafe equipment or equipment unsafely
5. ☐ Unsafe Loading, Placing, Mixing
6. ☐ Taking Unsafe Position
7. ☐ Working on Moving or Dangerous Equipment
8. ☐ Distraction, Teasing, Horse Play
9. ☐ Failure to Use Personal Protective Devices

UNSAFE CONDITIONS

1. ☐ Inadequately guarded
2. ☐ Unguarded
3. ☐ Defective Tools, Equipment, or Substance
4. ☐ Unsafe Design or Construction
5. ☐ Hazardous Arrangements
6. ☐ Unsafe Illumination
7. ☐ Unsafe Ventilation
8. ☐ Unsafe Clothing

Why was the unsafe act committed? ____________________

Why did the unsafe condition exist? ____________________

____

____

Any pre-existing physical disabilities? ____________________

____

GUIDES TO CORRECTIVE ACTION

Based on the cause checked above, indicate below the corrective action you are taking:

UNSAFE ACT

1. ☐ Stop the Worker
2. ☐ Study the Job
3. ☐ Instruct (Tell-Show-Try-Check)
4. ☐ Follow Up
5. ☐ Enforce

UNSAFE CONDITION

1. ☐ Remove
2. ☐ Guard
3. ☐ Warn
4. ☐ Recommendation to Maintenance Department
5. ☐ Recommendation to my Supervisor
6. ☐ Follow Up

What are you actually doing to prevent similar injuries? ____________________

____

____

____

TABLE B-8 (Cont.)

What further recommendations?____

____

____

____

Eyewitnesses____

(1) Only one "X" can be used for the 17 selections of unsafe acts and unsafe conditions.
(2) There can be several "O's" used to list contributing factors.

PERSONNEL DEPARTMENT USE ONLY

Employee's address____

Date employee reported injury____________________Date reported to state or insurance company__________

First day off work__________________________Estimated disability time__________________

Dates of previous injuries or alleged claims_____________________________________

____

____

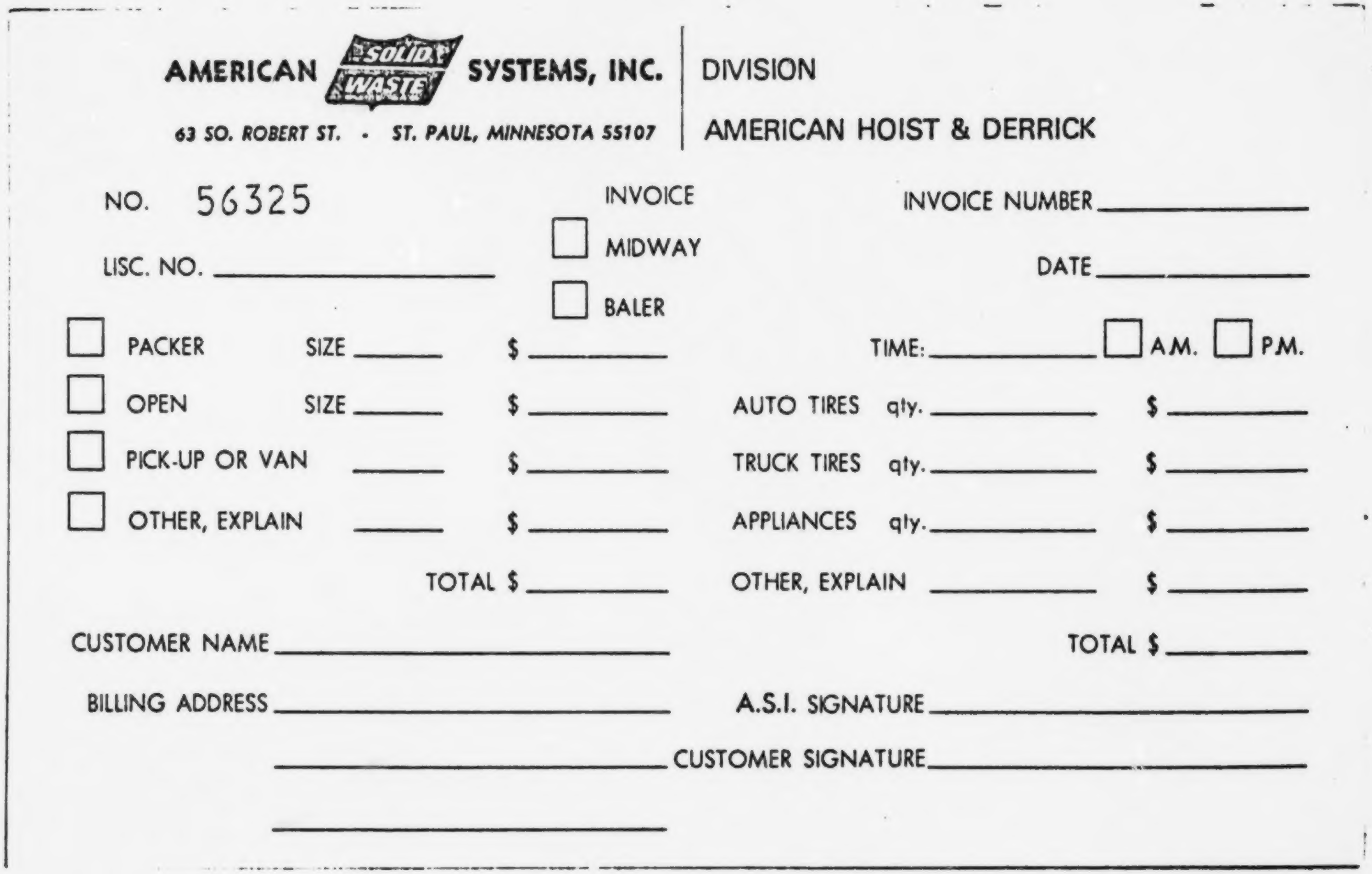
Number of first aid cases prior 12 months______________________________________

Date of employment__________________________Service in company______________________

Service in department________________________Service on job__________________________

NOTE: Submit photos, sketches, medical reports (when available), statements, etc., to complement the report.
NOTE: Carry this information over to the OSHA 100 (Log) form.

TABLE B - 9
INVOICE FORM



AMERICAN SOLID WASTE **SYSTEMS, INC.** | DIVISION

63 SO. ROBERT ST. - ST. PAUL, MINNESOTA 55107 | AMERICAN HOIST & DERRICK

NO. 56325

INVOICE

☐ MIDWAY

☐ BALER

INVOICE NUMBER ____

LISC. NO. ____

DATE ____

☐ PACKER SIZE ____ $ ____

☐ OPEN SIZE ____ $ ____

☐ PICK-UP OR VAN ____ $ ____

☐ OTHER, EXPLAIN ____ $ ____

TOTAL $ ____

TIME: ____ ☐ A.M. ☐ P.M.

AUTO TIRES qty. ____ $ ____

TRUCK TIRES qty. ____ $ ____

APPLIANCES qty. ____ $ ____

OTHER, EXPLAIN ____ $ ____

TOTAL $ ____

CUSTOMER NAME ____

BILLING ADDRESS ____

____

____

A.S.I. SIGNATURE ____

CUSTOMER SIGNATURE ____

TABLE B-10
PREVENTIVE MAINTENANCE PROCEDURE

Description of Equip. Dept_____Bldg #______	WORK PERFORMED BY DEPT #											PERIOD - WEEK										DAY							SHIFT			TIMES/YEAR
					95																											
Work Description:	30	37	55	66	R	G	T	F	O	96		1	2	3	4	5	6	7	8	9	10	S	M	T	W	T	F	S	1	2	3	

APPENDIX C

BALING PLANT EQUIPMENT DESCRIPTION

TABLE C - 1
EXISTING 137 - SECOND CYCLE BALER DESCRIPTION

HARRIS PRESS & SHEAR CORPORATION
SALES OFFICE 63 SO. ROBERT STREET, ST. PAUL, MINNESOTA 55107
SUBSIDIARY OF AMERICAN HOIST

DATE:

PROPOSAL SPECIFICATION: 710925

AUTOMATIC BALING PRESS MODEL: SWC-2528-36x36

STYLE: Offset Box

GENERAL LAYOUT DRAWING: 4A-5588

	APPLICATION:	Carefully selected solid waste material suitable for packer truck handling
A	CAPACITY AND RATING:	
A1	WEIGH HOPPER LOADING DIMENSIONS:	144" wide x 36" deep x 228" long (684 cubic ft)
A2	CHARGING BOX OPENING:	68" x 228"
A3	PRESS BOX DIMENSIONS:	68" wide x 60" deep x 280 1/2" long
A4	PRESS BOX CAPACITY:	680 cubic feet
A4.1	BALE CHAMBER:	70" wide x 123" deep x 36" long
A4.2	CHAMBER CAPACITY:	179 cubic feet
A5	BALE SIZE:	36" x 36" x variable
A6	BALING FORCES:	
A6.1	FIRST COMPRESSION RAM FACE:	172 p.s.i.
A6.2	SECOND COMPRESSION RAM FACE:	1450 p.s.i.
A6.3	THIRD COMPRESSION RAM FACE:	2740 p.s.i.
A7	BALE WEIGHT:	Average 2000-3000 lb
A7.1	COMPRESSED:	2500 lb average, 36"x 36"x 48"
A7.2	EXPANDED:	2500 lb average, 38" x 38"x 60"
A8	BALING CYCLE:	137 seconds (44 cycles/hour)
B	COMPONENTS:	
B1	ELECTRIC MOTORS:	
B1.1	MAIN SYSTEM:	Three (3) 150 HP, 1750 RPM, 460 volt, 3ϕ, 60 Hertz, protected.

B COMPONENTS: (Continued)

TABLE C- 1 (Cont.)

B1 ELECTRIC MOTORS: (Continued)

B1.2 PILOT SYSTEM: One (1) 25 HP, 1750 RPM, 230/460 volt, 3ø, 60 Hertz, protected.

B1.3 COOLING SYSTEM: One (1) 3 HP, 3500 RPM, 230/460 volt, 3ø, 60 Hertz, protected.

B1.4 SUPERCHARGE SYSTEM: One (1) 25 HP, 3500 RPM, 230/460 volt, 3ø, 60 Hertz, protected.

B2 ELECTRIC CONTROL SYSTEM:

B2.1 One (1) NEMA Class 2, Type C, NEMA 1A enclosed motor control center equipped with combination circuit breakers and across-the-line motor starters for 440 to 600 volt power with control transformers.

B2.2 One (1) operator's station enclosure to include oil tight control switches and signal lights, wired to terminal strips.

B3 HYDRAULIC SYSTEM:

B3.1 MAIN PUMPS: Three (3) Vickers 75 GPM and 3500 psi max.
Three (3) Vickers 150 GPM and 2000 psi max.

B3.2 PILOT PUMP: One (1) Vickers 18/7 1/2 GPM and 2000/750 psi

B3.3 HEAT EXCHANGER: One (1) 75 GPM and 20 psi

B3.4 SUPERCHARGE PUMP: One (1) 320 GPM and 50 psi

B3.5 VALVES: Harris or equal

B3.5.1 Individual relief valves protect each pump from overload pressure.

B3.5.2 Directional valves are electrically controlled and hydraulically operated.

B3.6 CYLINDERS: Harris double acting all places; Teflon protected pistons in honed bores; rods flame hardened, ground and polished; standardized rod wipers, chevron packing and "O" ring gaskets.

B3.6.1 FIRST COMPRESSION: 16" bore, 352 tons

B3.6.2 SECOND COMPRESSION: 36" bore, 1780 tons

B3.6.3 THIRD COMPRESSION: 36" bore, 1780 tons

B3.6.4 BALE GATE: 12" bore, 113 tons

B3.6.5 HOPPER: 10" bore, 78 tons

B3.6.6 COVER: 12" bore, 113 tons

TABLE C-1 (Cont.)

B COMPONENTS: (Continued)

B4 FILTERING AND COOLING SYSTEM:

B4.1 Filtering is by combination of screens, tank magnets and replaceable cartridge type micronic filters.

B4.2 Standard cooling system is oil to water type heat exchanger.

C OPERATION:

C1 There are three modes of operation: Manual, semi-automatic and automatic repeat. Manual operation is provided primarily for set up and maintenance purposes. Semi-automatic is usually preferred in conjunction with batch feeding. Automatic repeat mode is normally synchronized with conveyor or other automatic methods of charging waste and handling finished bales.

C2 With weigh hopper the charging sequence is as follows: All waste is weighed by the hopper and dumped from the hopper into the press. When the press is being operated in the semi-automatic mode, the hopper is dumped by manual pushbutton and the baling cycle is initiated by manual pushbutton, each from the operator's station. When the press is operated in the automatic repeat mode, the hopper dumping cycle is synchronized with the baling cycle and interlocked with the scale so that the press is charged only when the baling cycle is in the correct phase and the proper weight of waste is in the hopper. Dumping of the hopper also initiates the subsequent baling cycle of the press.

C3 At the start of a baling cycle the first compression ram extends fully forward; the second compression ram extends to the fully down position and the third compression then extends to complete the bale. The bale door opens and the bale is ejected by the third compression ram. In proper sequence, the third compression ram retracts, the bale door closes, the second and first compression rams retract to complete one baling cycle.

D CONSTRUCTION:

D1 The Model SWC-2528-36x36 design follows established Harris standards.

D2 Major sub-assemblies are heavy plate and structural weldments, stress relieved before machining to design dimensions.

D3 Final assembly is bolted and keyed in accordance with good engineering practices.

D4 Press box, baling chamber and ram wear surfaces are fitted with replaceable wear plates of heat treated alloy steel.

D5 All liner plates are sectional design for ease of replacement.

D6 The compression faces of all rams are fitted with replaceable wear plates of heat treated alloy steel.

D7 All raplaceable wear plates are securely fastened with Harris patented screws and through bolts.

TABLE C-1 (Cont.)

D CONSTRUCTION: (Continued)

D8 All rams are box type steel weldments, stress relieved and machined to design dimensions.

D9 Hopper is single weldment from steel plate and structurals.

D9.1 Weighing means is by load cells.

D10 All pipe is electrically welded and securely anchored.

D11 Pipe flanges are steel, bolted type, with "O" ring gaskets.

D12 Each Harris machine is completely assembled, operated and tested before shipment.

D13 Standard paint is machinery enamel over primer coat.

D14 Shipping weight: 740,000 lb, approx

E GENERAL:

E1 Layout and foundation prints show above grade dimensions and conditions. Below grade soil conditions, piers, piling, footings and associated components are matters of local determination for which Harris can accept no responsibility.

E2 Harris technical services are available on a free advisory basis to assist in determining the location and material flow conditions best suited to utilize the high production of Harris equipment.

E3 This proposal also includes the services of a qualified installation specialist for 10 eight-hour working days. He will supervise the unloading and assembling of the press, place the press in operation and instruct your operator in recommended operating and maintenance procedures. (Transportation and sustenance outside the continental United States is for the purchaser's account.)

F EXPENSES ASSUMED BY THE PURCHASER TO COMPLETE THE MACHINE INSTALLATION:

F1 Railroad freight from Cordele to destination.

F2 Preparation of foundation.

F3 Unloading and assembling the press.

F4 Wiring from power source to electric control panel.

F5 Wiring from panel to main and auxiliary motors, also control wiring from panel to junction boxes and to pushbutton station.

F6 Furnishing all fuses.

F7 Making connections to filter and cooler.

F8 Furnishing approximately 1800 gallons of hydraulic oil for the hydraulic system.

TABLE C - 1 (Cont.)

G WARRANTY:

G1 The seller guarantees its product for the period of six months after date of delivery FOB Cordele, Georgia, against defects in material and workmanship for use within the capacity defined in Section A. No guarantee shall exist if unauthorized alterations have been made by the owner or user, or stated capabilities of machine exceeded. In case any material or workmanship shall prove defective, the seller's liability will be limited to repairing any defect in workmanship or replacing defective part packaged for shipment FOB Cordele, Georgia. All outside purchased equipment and accessories are guaranteed only to the extent of the original manufacturer's guarantee, shear blades included, no exceptions. Manufacturer reserves the right to change the design and construction of the product when in their opinion it represents an improvement of any part or the entire product. Seller shall have no liability or responsibility for consequential damages of any kind including damage or injury to persons or property arising out of use or operation of said article.

TABLE C - 2

90 - SECOND, CYCLE BALER DESCRIPTION

PROPOSAL NO.__________PAGE__________

PROPOSAL SPECIFICATION: 711004

AUTOMATIC BALING PRESS MODEL: SWC-2528-36 x 36 - 4

STYLE: Offset Box

GENERAL LAYOUT DRAWING: 4A-5588

APPLICATION:		Solid waste material suitable for packer truck handling.
A	CAPACITY AND RATING:	
A1	WEIGH HOPPER LOADING DIMENSIONS:	144" wide x 36" deep x 228" long (684 cubic ft.)
A2	CHARGING BOX OPENING:	68" x 228"
A3	PRESS BOX DIMENSIONS:	68" wide x 60" deep x 280 1/2" long
A4	PRESS BOX CAPACITY:	680 cubic ft.
A4.1	BALE CHAMBER:	70" wide x 123" deep x 36" long
A4.2	CHAMBER CAPACITY:	179 cubic ft.
A5	BALE SIZE:	36" x 36" x variable
A6	BALING FORCES:	
A6.1	FIRST COMPRESSION RAM FACE:	172 p.s.i.
A6.2	SECOND COMPRESSION RAM FACE:	1450 p.s.i.
A6.3	THIRD COMPRESSION RAM FACE:	2740 p.s.i.
A7	BALE WEIGHT:	Average 2000-3000 lb.
A7.1	COMPRESSED:	2500 lb. average, 36" x 36" x 48"
A7.2	EXPANDED:	2500 lb. average, 38" x 38" x 60"
A8	BALING CYCLE:	90 seconds (40 cycles/hour)
B	COMPONENTS:	
B1	ELECTRIC MOTORS:	
B1.1	MAIN SYSTEM:	Four (4) 150 HP, 1750 RPM, 460 volt, 3ϕ, 60 Hertz, protected.

TABLE C - 2 (Cont.)

PROPOSAL NO.__________PAGE__________

B COMPONENTS: (Continued)

B1 ELECTRIC MOTORS: (Continued)

B1.2 PILOT SYSTEM: One (1) 25 HP, 1750 RPM, 230/460 volt, 3ɸ, 60 Hertz, protected.

B1.3 COOLING SYSTEM: One (1) 3 HP, 3500 RPM, 230/460 volt, 3ɸ, 60 Hertz, protected.

B1.4 SUPERCHARGE SYSTEM: One (1) 25 HP, 3500 RPM, 230/460 volt, 3ɸ, 60 Hertz, protected.

B2 ELECTRIC CONTROL SYSTEM:

B2.1 One (1) NEMA Class 2, Type C, NEMA 1A enclosed motor control center equipped with combination circuit breakers and across-the-line motor starters for 440 to 600 volt power with control transformers.

B2.2 One (1) operator's station enclosure to include oil tight control switches and signal lights, wired to terminal strips.

B3 HYDRAULIC SYSTEM:

B3.1 MAIN PUMPS: Four (4) Vickers 75 GPM and 3500 psi max.
Four (4) Vickers 150 GPM and 2000 psi max.

B3.2 PILOT PUMP: One (1) Vickers 18/7 1/2 GPM and 000/750 ps

B3.3 HEAT EXCHANGER: One (1) 75 GPM and 20 psi

B3.4 SUPERCHARGE PUMP: One (1) 320 GPM and 50 psi

B3.5 VALVES: Harris or equal

B3.5.1 Individual relief valves protect each pump from overload pressure.

B3.5.2 Directional valves are electrically controlled and hydraulically operated.

B3.6 CYLINDERS: Harris double acting all places; Teflon protected pistons in honed bores; rods flame hardened, ground and polished; standardized rod wipers, chevron packing and "O" ring gaskets.

B3.6.1 FIRST COMPRESSION: 16" bore, 352 tons

B3.6.2 SECOND COMPRESSION: 36" bore, 1780 tons

B3.6.3 THIRD COMPRESSION: 36" bore, 1780 tons

TABLE C - 2 (Cont.)

B COMPONENTS: (Continued)

B3.6 CYLINDERS: (Continued)

B3.6.4 BALE GATE: 12" bore, 113 tons

B3.6.5 HOPPER: 10" bore, 78 tons

B3.6.6 COVER: 12" bore, 113 tons

B4 FILTERING AND COOLING SYSTEM:

B4.1 Filtering is by combination of screens, tank magnets and replaceable cartridge type micronic filters.

B4.2 Standard cooling system is oil to water type heat exchanger.

C OPERATION:

C1 There are three modes of operation: Manual, semi-automatic and automatic repeat. Manual operation is provided primarily for set up and maintenance purposes. Semi-automatic is usually preferred in conjunction with batch feeding. Automatic repeat mode is normally synchronized with conveyor or other automatic methods of charging waste and handling finished bales.

C2 With weigh hopper the charging sequence is as follows: All waste is weighed by the hopper and dumped from the hopper into the press. When the press is being operated in the semi-automatic mode, the hopper is dumped by manual pushbutton and the baling cycle is initiated by manual pushbutton, each from the operator's station. When the press is operated in the automatic repeat mode, the hopper dumping cycle is synchronized with the baling cycle and interlocked with the scale so that the press is charged only when the baling cycle is in the correct phase and the proper weight of the waste is in the hopper. Dumping of the hopper also initiates the subsequent baling cycle of the press.

C3 At the start of a baling cycle the first compression ram extends fully forward; the second compression ram extends to the fully down position and the third compression then extends to complete the bale. The bale door opens and the bale is ejected by the third compression ram. In proper sequence, the third compression ram retracts, the bale door closes, the second and first compression rams retract to complete one baling cycle.

D CONSTRUCTION:

D1 The Model SWC-2528-36 x 36 design follows established Harris standards.

D2 Major sub-assemblies are heavy plate and structural weldments, stress relieved before machining to design dimensions.

D3 Final assembly is bolted and keyed in accordance with good engineering practices.

TABLE C - 2 (Cont.)

PROPOSAL NO.__________PAGE__________

D CONSTRUCTION: (Continued)

D4 Press box, baling chamber and ram wear surfaces are fitted with replaceable wear plates of heat treated alloy steel.

D5 All liner plates are sectional design for ease of replacement.

D6 The compression faces of all rams are fitted with replaceable wear plates of heat treated alloy steel.

D7 All replaceable wear plates are securely fastened with Harris patented screws and through bolts.

D8 All rams are box type steel weldments, stress relieved and machined to design dimensions.

D9 Hopper is single weldment from steel plate and structurals.

D9.1 Weighing means is by load cells.

D10 All pipe is electrically welded and securely anchored.

D11 Pipe flanges are steel, bolted type, with "O" ring gaskets.

D12 Each Harris machine is completely assembled, operated and tested before shipment.

D13 Standard paint is machinery enamel over primer coat.

D14 Shipping weight: 750,000 lb., approximate

E GENERAL:

E1 Layout and foundation prints show above grade dimensions and conditions. Below grade soil conditions, piers, piling, footings and associated components are matters of local determination for which Harris can accept no responsibility.

E2 Harris technical services are available on a free advisory basis to assist in determining the location and material flow conditions best suited to utilize the high production of Harris equipment.

E3 This proposal also includes the services of a qualified installation specialist for 10 eight-hour working days. He will supervise the unloading and assembling of the press, place the press in operation and instruct your operator in recommended operating and maintenance procedures. (Transportation and sustenance outside the continental United States is for the purchaser's account.)

F EXPENSES ASSUMED BY THE PURCHASER TO COMPLETE THE MACHINE INSTALLATION:

F1 Railroad freight from Cordele to destination.

F2 Preparation of foundation.

AMERICAN SOLID WASTE SYSTEMS

63 SO. ROBERT ST. • ST. PAUL, MINNESOTA 55107
DIVISION OF AMERICAN HOIST & DERRICK COMPANY

TABLE C - 2 (Cont.)

F EXPENSES ASSUMED BY THE PURCHASER TO COMPLETE THE MACHINE INSTALLATION: (Continued)

F3 Unloading and assembling the press.

F4 Wiring from power source to electric control panel.

F5 Wiring from panel to main and auxiliary motors, also control wiring from panel to junction boxes and to pushbutton station.

F6 Furnishing all fuses.

F7 Making connections to filter and cooler.

F8 Furnishing approximately 1800 gallons of hydraulic oil for the hydraulic system.

G WARRANTY:

G1 The seller guarantees its product for the period of six months after date of delivery FOB Cordele, Georgia, against defects in material and workmanship for use within the capacity defined in Section A. No guarantee shall exist if unauthorized alterations have been made by the owner or user, or stated capabilities of machine exceeded. In case any material or workmanship shall prove defective, the seller's liability will be limited to repairing any defect in workmanship or replacing defective part packaged for shipment FOB Cordele, Georgia. All outside purchased equipment and accessories are guaranteed only to the extent of the original manufacturer's guarantee, shear blades included, no exceptions. Manufacturer reserves the right to change the design and construction of the product when in their opinion it represents an improvement of any part or the entire product. Seller shall have no liability or responsibility for consequential damages of any kind including damage or injury to persons or property arising out of use or operation of said article.

Reproduced from best available copy.

TABLE C - 3

EPA CONTRACT NO. 68-03-0332/AMERICAN HOIST COMPANY

EQUIPMENT DATA FORM

Equipment name Forklift

Use Remove cardboard bales, lift wood, lift parts, etc.

Manufacturer Clark Equipment Company

Model Clarklift CF 40 Type G Serial CF 40B-149-2052 069

Size NA Class NA

Mfrs. max. load 4,000 lbs (1,816 kg) Mfrs. max. rate 2,000 lbs (908 kg)

Bale plant design load 4,000 lbs (1,816 kg) Bale plant design rate 2,000 lbs (908 kg)

Utilities 1) None 2) 3)
(Voltage, pipe size, flow capacity)
4) 5)

New price Depreciation rate period

Overhaul price Setup price

Parts inventory

Backup equipment

Specs: Weight 3,940 lbs (1,789 kg) Dimensions 38" W x 84" H x 118" L (0.97 m x 2.13 m x 3.0 m)

Mounting Rubber tires Power

Auxiliary equipment/
fittings/tools/attachments None

TABLE C-4

EPA CONTRACT NO. 68-03-0332/AMERICAN HOIST COMPANY

EQUIPMENT DATA FORM

Equipment name Bobcat Loader (On Loan)

Use Push segregated cardboard to store; feed conveyor, cleanup

Manufacturer International Harvester

Model 3200 A Serial

Size Class

Mfrs. max. load 1,500 lbs (13 cu ft) (681 kg) (0.36 cu m) Mfrs. max. rate Speed 0-8 mph (0- 5 km/h)

Operating capacity 1,250 lbs (568 kg) Bale plant design rate

Utilities 1) 2) 3)
(Voltage, pipe size, flow capacity)
4) 5)

New price Depreciation rate period

Overhaul price Setup price

Parts inventory

Backup equipment

Specs: Weight 3,620 lbs (1643 kg) Dimensions Overall W - 43" x 56" H x 116" L (with bucket) (1.09 m x 1.42 m x 2.95 m)

Mounting Rubber tires (4) Power 30 brake horsepower @ 2,800 rpm

Auxiliary equipment/
fittings/tools/attachments Engine: Wisconsin VH 4D, 4 cyl, 4 cycle

TABLE C-5

EPA CONTRACT NO. 68-03-0332/AMERICAN HOIST COMPANY

EQUIPMENT DATA FORM

Equipment name Bobcat - Wheeled loader (in repair during monitoring)

Use Segregate to stack carboard & metal; general cleanup; pile solid waste; feed baler conveyor

Manufacturer Melroe Div. Gwinner, No. Dakota
Clark Equipment Company

Model 600 Serial 70393

Size Class NA

Mfrs. max. load 1/2 cu yd (.38 cu m) Mfrs. max. rate NA

Bale plant design load 1/2 cu yd (.38 cu m Bale plant design rate NA

Utilities 1) 2) 3)
(Voltage, pipe size, flow capacity)
4) 5)

New price Depreciation rate period

Overhaul price Setup price

Parts inventory

Backup equipment

Specs: Weight Dimensions 5 ft H x 5 ft W x 9 ft L (16.4 m x 16.4 m x 29.5 m)

Mounting Wheeled - rubber tire -4

Power Wisconsin; heavy duty air-cooled,
Model VF4D
Size - 3 1/4" x 3 1/4" (8.26 cm x 8.26 cm)
Spec. no. 322060
Serial no. 4905230
Wisconsin Motor Corp.
Milwaukee, Wisconsin

Auxiliary equipment/
fittings/tools/attachments

TABLE C-6

EPA CONTRACT NO. 68-03-0332/AMERICAN HOIST COMPANY

EQUIPMENT DATA FORM

Equipment name 42 E Sweeper

Use Sweep up tipping floor

Manufacturer Tennant Co., Minneapolis, Minnesota

Model 42 Heavy duty (42E-Hd) Serial 0555

Size Overall-62" L x 35" W x 34" H (1.5 m x .89 m x .86 m) sweeper area on floor - 27" W x 12" L (68.6 cm x 30.5 cm) Class NA

Mfrs. max. load NA Mfrs. max. rate NA

Bale plant design load NA Bale plant design rate NA

Utilities 1) 24 volt 2) 3)
(Voltage, pipe size, flow capacity)
4) 5)

New price Depreciation rate period

Overhaul price Setup price

Parts inventory

Backup equipment Truck sweeper

Specs: Weight 150 lbs (68 kg) Dimensions See size above

Mounting Rubber wheels 9" O.D. x 1 1/2" Thd (22.9 cm x 3.8 cm) Power Wall socket for charging battery

Auxiliary equipment/ fittings/tools/attachments Electric cord for charging battery

TABLE C-7

EPA CONTRACT NO. 68-03-0332/AMERICAN HOIST COMPANY

EQUIPMENT DATA FORM

Equipment name Loader

Use Feed solid waste to conveyor

Manufacturer Caterpillar

Model 930 Serial

Size See dimensions below Class

Mfrs. max. load 2¼ cu yd (1.72 m^3) 19,700 lb (8,930 kg) Mfrs. max. rate NA

Bale plant design load NA Bale plant design rate NA

Utilities 1) 2) 3)
(Voltage, pipe size, flow capacity)
4) 5)

New price $31,781 Depreciation rate period

Overhaul price Setup price

Parts inventory

Backup equipment

Specs: Weight 20,494 lb (9,220 kg) Dimensions 15'6½"H X 20'6" L (4.74 m X 6.25 m)

Mounting Power 100 flywheel horsepower @ 2,200 rpm

Auxiliary equipment/
fittings/tools/attachments

'/73

TABLE C-8

EPA CONTRACT NO. 68-03-0332/AMERICAN HOIST COMPANY

EQUIPMENT DATA FORM

Equipment name Portable Light Generator

Use 4 mercury vapor load lights

Manufacturer Onan

Model 6DJB-3E2236 Serial #1170268978

Size 6 KW 120/240 A.C. Class 60 cycle 1800 rpm Battery = 12V

Mfrs. max. load A.C. Amp = 25 Mfrs. max. rate Diesel 220 V

Bale plant design load Bale plant design rate

Utilities 1) 2) 3)
(Voltage, pipe size, flow capacity)
4) 5)

New price $2,185.00 Depreciation rate period

Overhaul price Setup price

Parts inventory

Backup equipment

Specs: Weight 485 lb (218 kg) Dimensions 34 3/4" L x 17 1/8" W x 27 1/4" H (88 cm x 43 cm x 69 cm)

Mounting Power

Auxiliary equipment/
fittings/tools/attachments

TABLE C-9
RECOMMENDED SPARE PARTS LIST

Item No.	Quantity	Part No.	Part Name	Price
FIRST COMPRESSION - GATHERER				
1	1	1118-M1	Rod Packing	$ 67.37
2	2	2119-H5	Rod Bushings - Inner & Outer	175.61
3	1	818956	Rear Head "O" Ring (1700.25)	5.31
4	1	21643-AO	Bolting Flange	689.74
5	1	4289-AO	Packing Ring	824.55
6	1	20527-GO	Packing Ring Dowel ½"x1"	.14
7	1	818950	"O" Ring (1300.25)	3.65
SECOND COMPRESSION & THIRD COMPRESSION				
8	2	1118-S1	Rod Packing	110.72
9	2	5834-A1	Rod Bushings - Inner & Outer	265.25
10	2	818970	Rear Head "O" Ring (3500.25)	7.62
11	2	818971	Rear Head "O" Ring (3600.25)	11.60
12	2	818885	Back-Up Washer (3600.25B)	87.26
13	1	6104-AO	Bolting Flange	910.05
14	1	7937-AO	Packing Ring	1,204.73
15	1	20527-FO	Packing Ring Dowel ½"x3/4"	.56
16	1	818969	"O" Ring (3200.25)	9.23
BALE DOOR & LID CYLINDERS				
17	2	1118-H1	Rod Packing	28.43
18	2	1102-B5	Rod Bushing - Outer	15.18
19	2	1102-C5	Rod Bushing - Inner	15.18
20	3	818949	Cylinder Head "O" Rings (1200.25)	3.34
21	1	5188-A2	Bolting Flange	133.15
22	1	4083-A5	Packing Ring	359.84
23	1	20527-DO	Packing Ring Dowel 3/8 x ½	.14
24	1	818945	"O" Ring (1000.25)	1.78
"O" RINGS & SEALS FOR ROTARY VALVES & SHIFTER CYLINDERS				
25	4	818937	"O" Ring (700.13)	.87
26	2	819273	U-Cup Seal	2.47
27	8	818942	"O" Ring (900.13)	1.69
28	4	818847	U-Cup Seal	3.81

TABLE C-9 (Cont.)
RECOMMENDED SPARE PARTS LIST

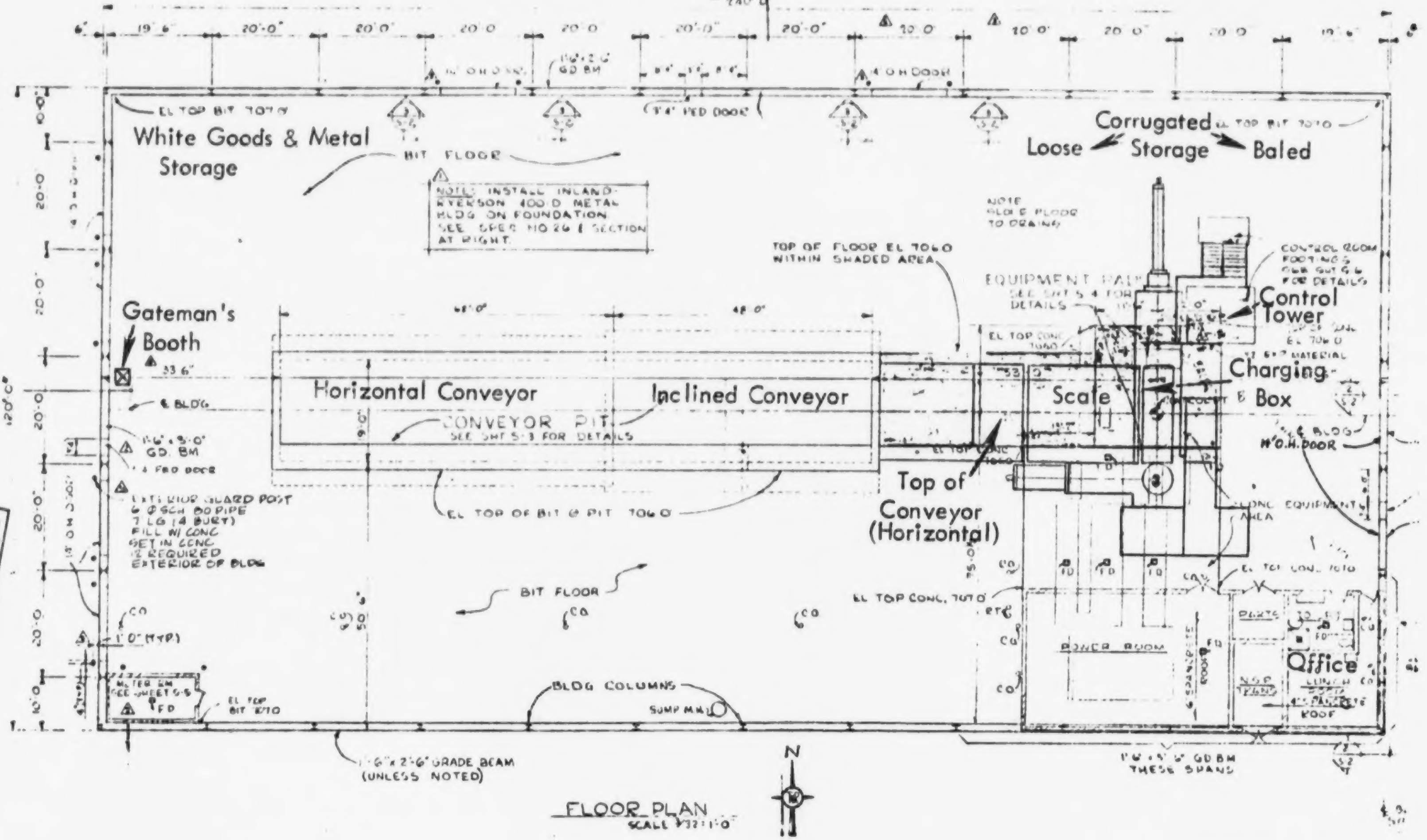
Item No.	Quantity	Part Number	Part Name	Price
29	12	818888	Back-Up Washer (100.13 B)	.06
30	6	818892	"O" Ring (100.13)	.13
31	12	818901	"O" Ring (200.13)	.20
32	12	811671	"O" Ring (275.13)	.25
33	12	818925	"O" Ring (375.13)	.36
			PIPING "O" RINGS	
34	12	805403	"O" Ring (275.19)	.24
35	12	810787	"O" Ring (388.19)	.29
36	5	818912	"O" Ring (488.19)	.56
37	11	811517	"O" Ring (500.13)	.60
38	12	818936	"O" Ring (675.25)	1.14
39	12	818941	"O" Ring (875.25)	2.66
			MISCELLANEOUS COMPONENTS	
40	1	818380	Vickers Piston Pump PFA50-30-R-12	2,998.27
41	1	833519	Vickers Vane Pump 50V100A-1C-10L	670.34
42	1	819456	Vickers Vane Pump 2520V12A-5-100-10	341.19
43	1	833520	Vickers Vane Pump 4535V60A38-1AC-10-L	553.13
44	1	819457	Vickers Solenoid Valve DG454-016-CH-50	190.70
45	1	818439	Vickers Solenoid Valve DG454-012-AH-50	122.00
46	1	818586	Vickers Solenoid End Assembly 195053	50.63
47	1	818410	Dual Snap Pressure Switch 604-PR-21	68.20
48	1	818409	Dual Snap Pressure Switch 604-PR-31	76.19
49	1	818412	Dual Snap Pressure Switch 604-GR-11	47.40
50	1	819326	Allen Bradley Limit Switch ASC2-1	30.48
51	1	819851	Sier-Bath Pump Coupling C2	38.05
52	1	819114	Sier-Bath Pump Coupling C2	104.35
53	1	833556	Sier-Bath Pump Coupling C2	90.05
54	1	825532	Electric Motor, 150 HP, Frame 445 TCZ	3,270.05

TABLE C-9 (Cont.)
RECOMMENDED SPARE PARTS LIST

Item No.	Quantity	Part Number	Part Name	Price
55	12	5582-J (20753-J2)	Capscrew 1"-8 unc x 4" lg. 50° fl. hd.	4.89
56	12	819966	Lock Nut 1"-8 unc-2B	.52
57	12	5582-C5	Capscrew 1"-8 unc x 2¼" lg. 50° fl. hd.	4.66
58	12	5582-D5	Capscrew 1"-8 unc x 2½" lg. 50° fl. hd.	3.25
59	12	5582-E5	Capscrew 1"-8 unc x 2-3/4" lg. 50° fl. hd.	4.09
60	12	5582-F5	Capscrew 1"-8 unc x 3" lg. 50° fl. hd.	4.13
61	12	5583-D4	Capscrew 1¼"-8 un x 2-3/4" lg. 50° fl. hd.	5.97
62	12	5583-E4	Capscrew 1¼"-8 un x 3" lg. 50° fl. hd.	6.49
63	12	5583-F4	Capscrew 1¼"-8 un x 3½" lg. 50° fl. hd.	10.32
64	5	5583-L4	Capscrew 1¼"-8 un x 6" lg. 50° fl. hd.	10.38
65	12	5583-R4	Capscrew 1¼"-8 un x 8½" lg. 50° fl. hd.	23.44
66	12	5584-D5	Capscrew 1½"-8 un x 3½" lg. 50° fl. hd.	13.02
67	12	5584-E5	Capscrew 1½"-8 un x 4" lg. 50° fl. hd.	13.32
68	8	5584-F5	Capscrew 1½"-8 un x 4½" lg. 50° fl. hd.	12.66
69	12	5586-D13	Capscrew 2"-8 un x 5" lg. 50° fl. hd.	24.82
70	12	5586-E13	Capscrew 2"-8 un x 5½" lg. 50° fl. hd.	22.72
71	12	5586-F13	Capscrew 2"-8 un x 6" lg. 50° fl. hd.	17.42
72	12	5586-G13	Capscrew 2"-8 un x 6½" lg. 50° fl. hd.	24.08
			MISCELLANEOUS CAPSCREWS	
73	12	809554	Capscrew 3/4"-10 unc x 1-3/4" lg. soc. hd.	.64
74	12	812053	Capscrew 3/4"-10 unc x 2½" lg. soc. hd.	.82
75	12	818038	Capscrew 1"-8 unc x 4½" lg. soc. hd.	2.45
76	8	818039	Capscrew 1"-8 unc x 5" lg. soc. hd.	2.73
77	12	818051	Capscrew 1¼"-7 unc x 4" lg. soc. hd.	6.39
78	12	2445-A19	Capscrew 2"-8 un x 9-3/4" lg. Harris hd.	36.42
79	12	2445-N19	Capscrew 2"-8 un x 10" lg. Harris Hd.	53.95
80	8	2444-E18	Capscrew 2½"-8 un x 6½" lg. Harris hd.	24.64
			TOTAL:	$ 13,931.01

APPENDIX D

BALING PLANT DETAILS



White Goods & Metal Storage
Corrugated Storage
Loose
Baled
Gateman's Booth
Horizontal Conveyor
Inclined Conveyor
CONVEYOR PIT
SEE SHT S-3 FOR DETAILS
Scale
Charging Box
Control Tower
Top of Conveyor (Horizontal)
Office
POWER ROOM
PARTS
BIT FLOOR
BLDG COLUMNS
SUMP MH
EL TOP OF BIT @ PIT 706.0
TOP OF FLOOR EL 706.0 WITHIN SHADED AREA
EQUIPMENT PAD
NOTE: INSTALL INLAND-RYERSON 400-D METAL BLDG ON FOUNDATION SEE SPEC NO 26 & SECTION AT RIGHT.
EXTERIOR GUARD POST 6 Ø SCH 80 PIPE 7 LG (4 BURY) FILL W/ CONC SET IN CONC 13 REQUIRED EXTERIOR OF BLDG
1'-6" x 2'-6" GRADE BEAM (UNLESS NOTED)
240'-0"
120'-0"
N
FLOOR PLAN
SCALE 1/32"=1'-0"

FIGURE D-1
BALING PLANT
FLOOR PLAN

Reproduced from best available copy.

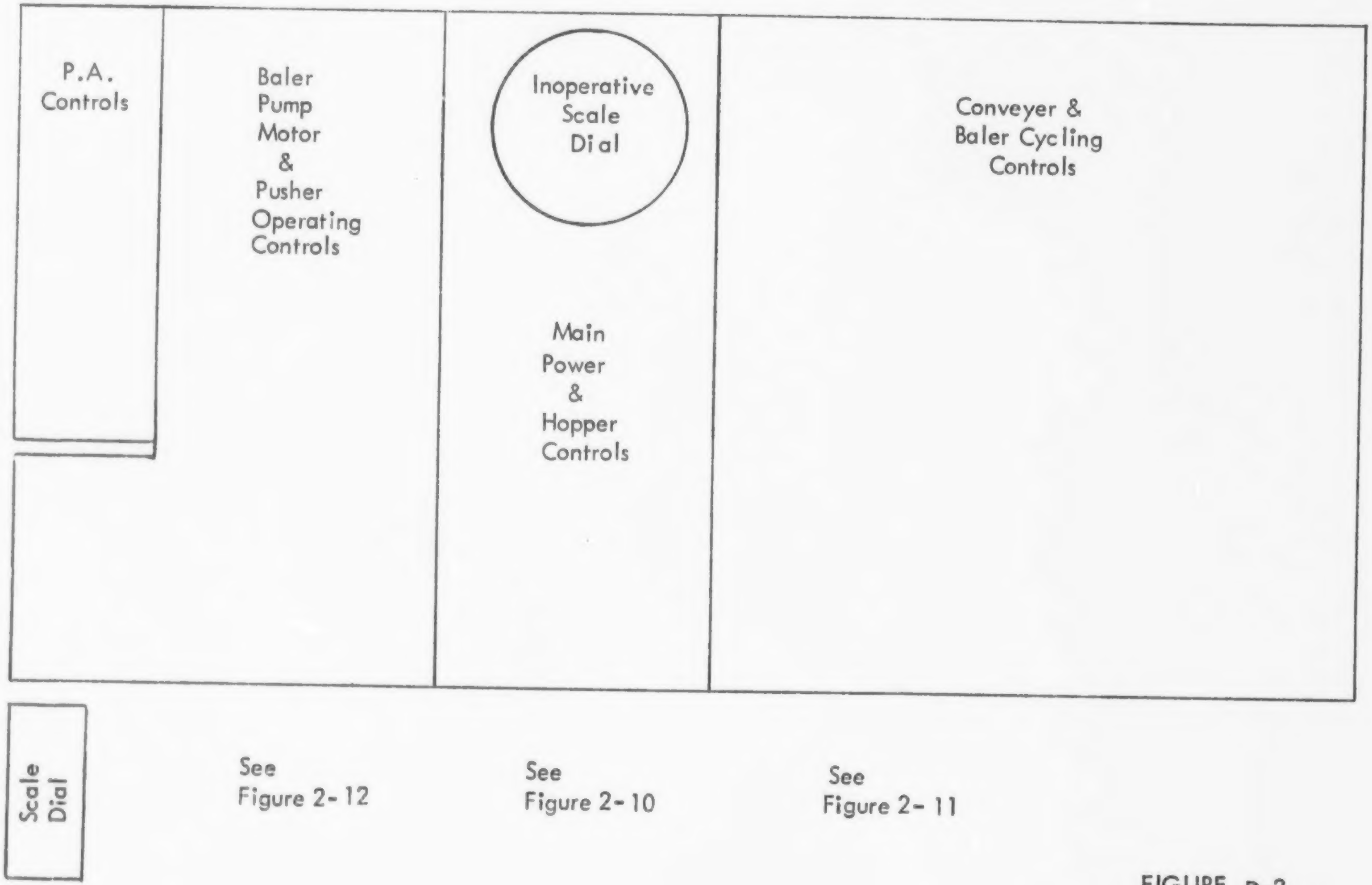
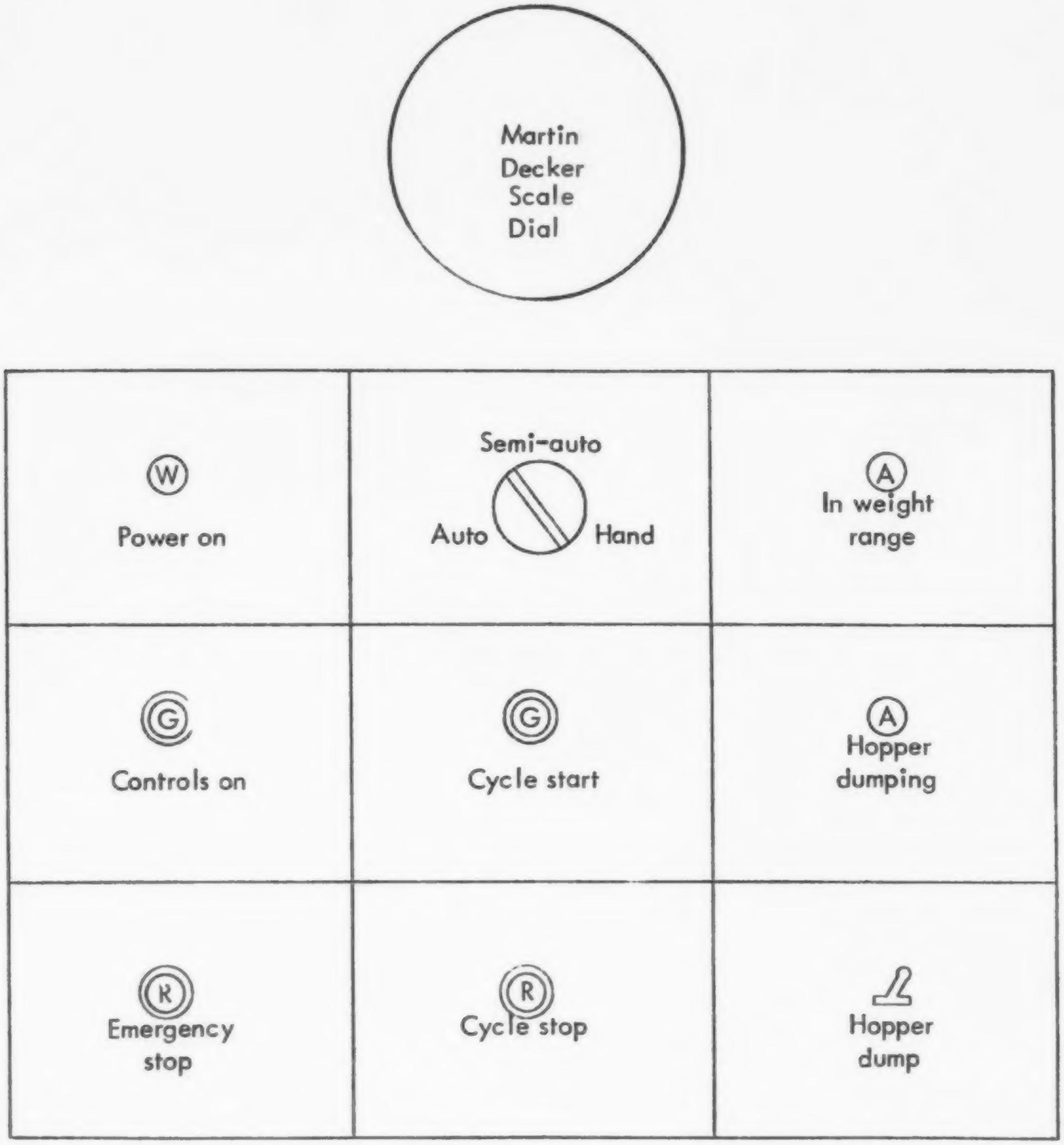

P.A. Controls
Baler Pump Motor & Pusher Operating Controls
Inoperative Scale Dial
Main Power & Hopper Controls
Conveyer & Baler Cycling Controls
Scale Dial
See Figure 2- 12
See Figure 2- 10
See Figure 2- 11

FIGURE D-2

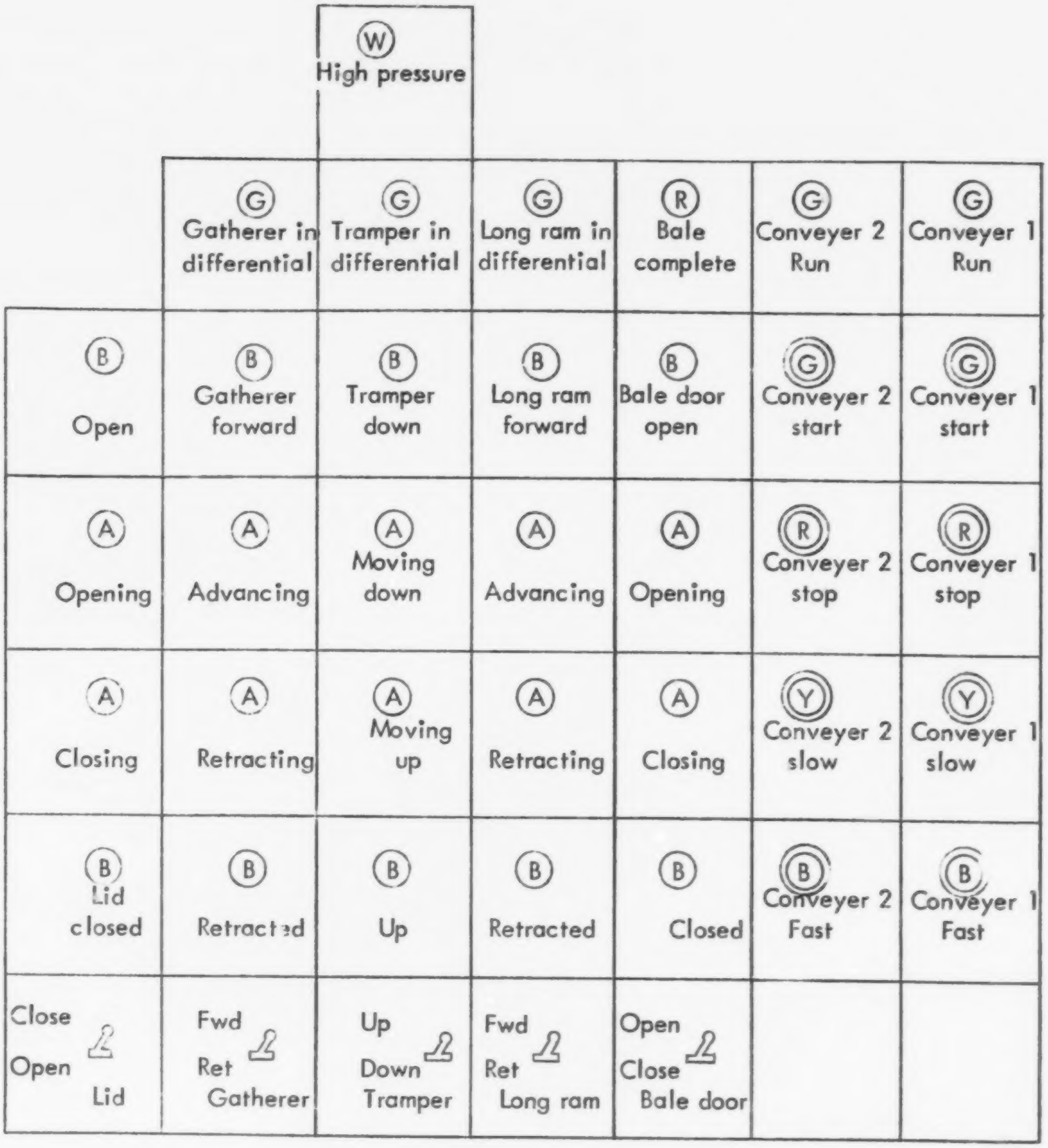
BALING PLANT CONTROL PANEL SCHEMATIC



Legend:
A - Amber
G - Green
R - Red
W - White

○ = Light
◎ = Button

FIGURE D-3
CONTROL PANEL - MIDDLE SECTION

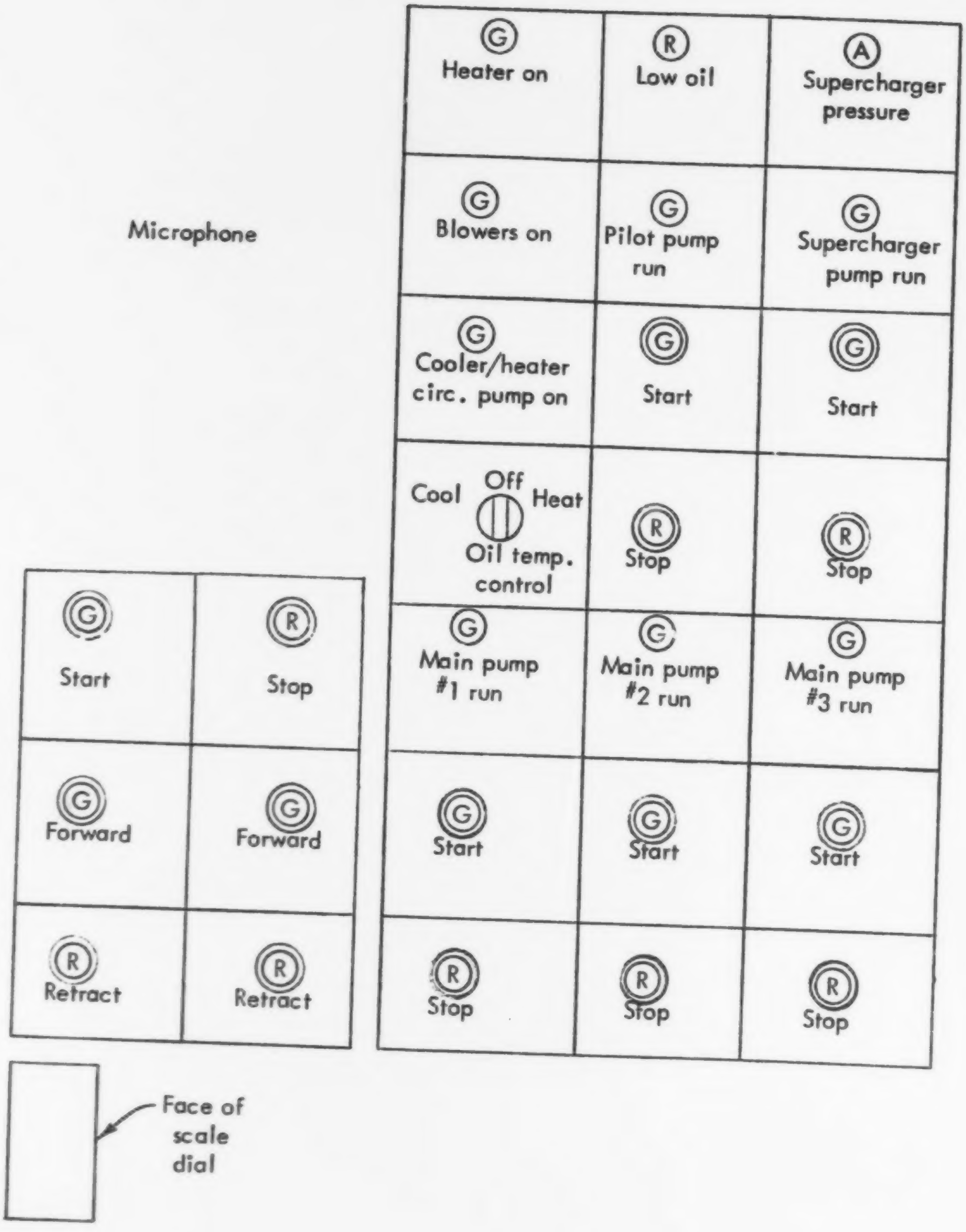


		Ⓦ High pressure				
	Ⓖ Gatherer in differential	Ⓖ Tramper in differential	Ⓖ Long ram in differential	Ⓡ Bale complete	Ⓖ Conveyer 2 Run	Ⓖ Conveyer 1 Run
Ⓑ Open	Ⓑ Gatherer forward	Ⓑ Tramper down	Ⓑ Long ram forward	Ⓑ Bale door open	Ⓖ Conveyer 2 start	Ⓖ Conveyer 1 start
Ⓐ Opening	Ⓐ Advancing	Ⓐ Moving down	Ⓐ Advancing	Ⓐ Opening	Ⓡ Conveyer 2 stop	Ⓡ Conveyer 1 stop
Ⓐ Closing	Ⓐ Retracting	Ⓐ Moving up	Ⓐ Retracting	Ⓐ Closing	Ⓨ Conveyer 2 slow	Ⓨ Conveyer 1 slow
Ⓑ Lid closed	Ⓑ Retracted	Ⓑ Up	Ⓑ Retracted	Ⓑ Closed	Ⓑ Conveyer 2 Fast	Ⓑ Conveyer 1 Fast
Close Open Lid	Fwd Ret Gatherer	Up Down Tramper	Fwd Ret Long ram	Open Close Bale door		

Legend:
A - Amber
B - Blue
G - Green
R - Red
W - White
Y - Yellow

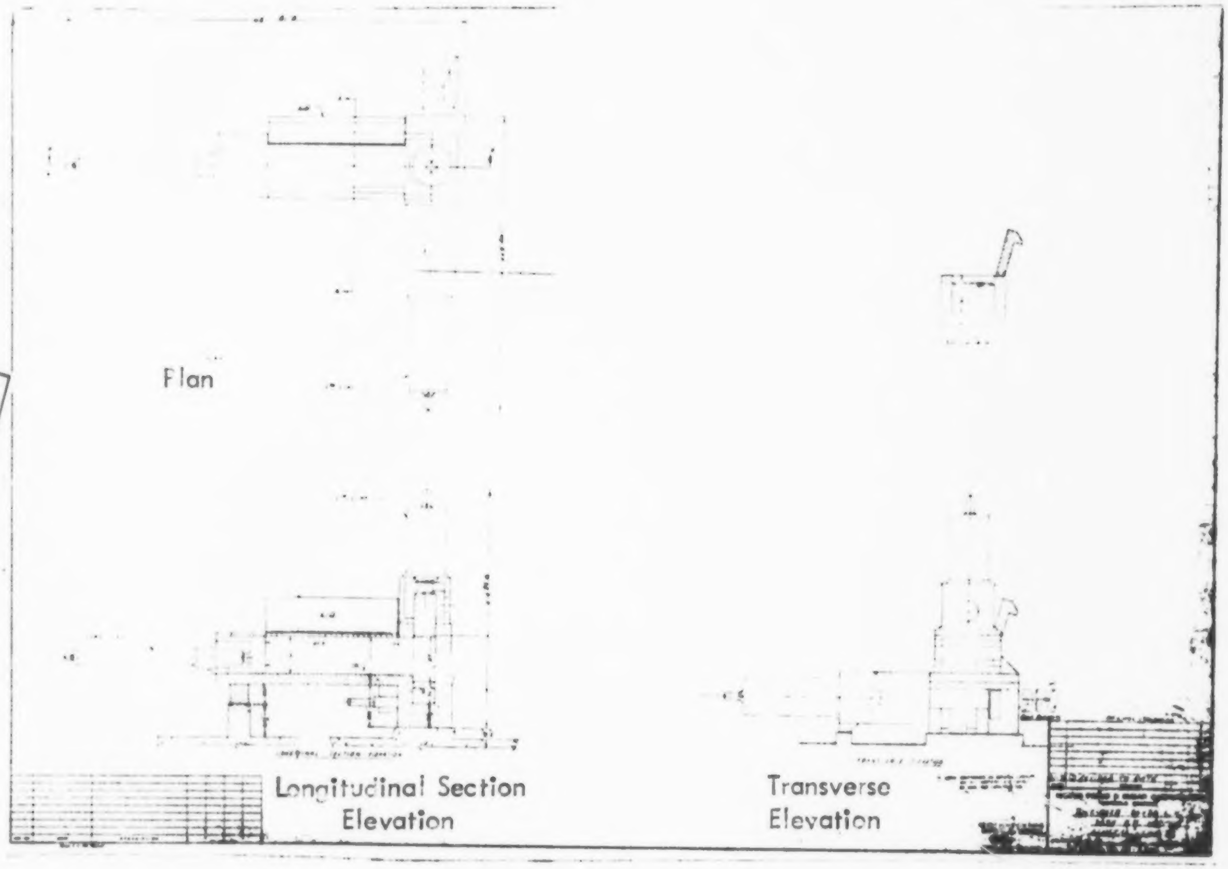
○ = Light
◎ = Button

FIGURE D-4
CONTROL PANEL - RIGHT SIDE



Legend:
A - Amber
G - Green
R - Red
○ = Light
◎ = Button

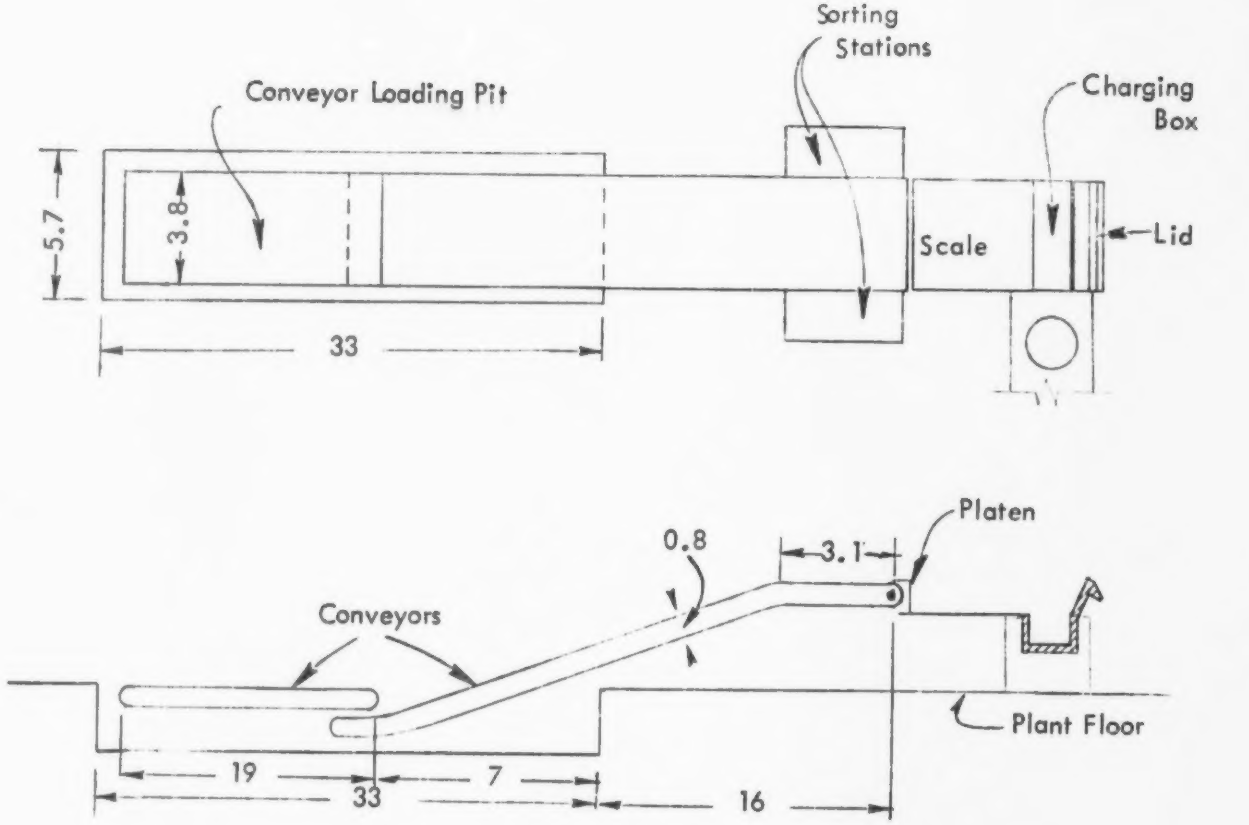
FIGURE D-5
CONTROL PANEL - LEFT SIDE



Reproduced from best available copy.

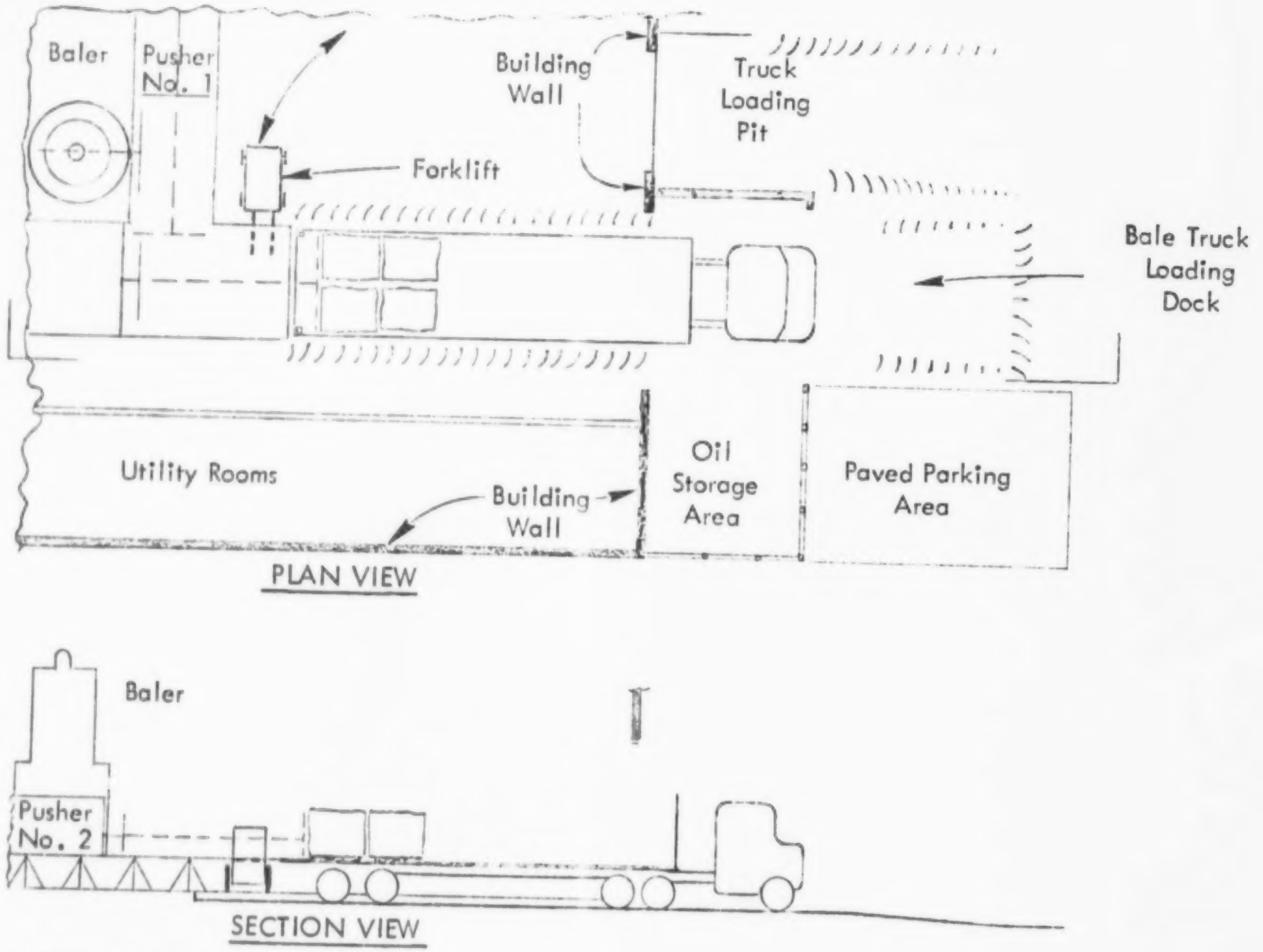
SOURCE: American Hoist and Derrick Company
No Scale

FIGURE D-6
BALER DETAILS



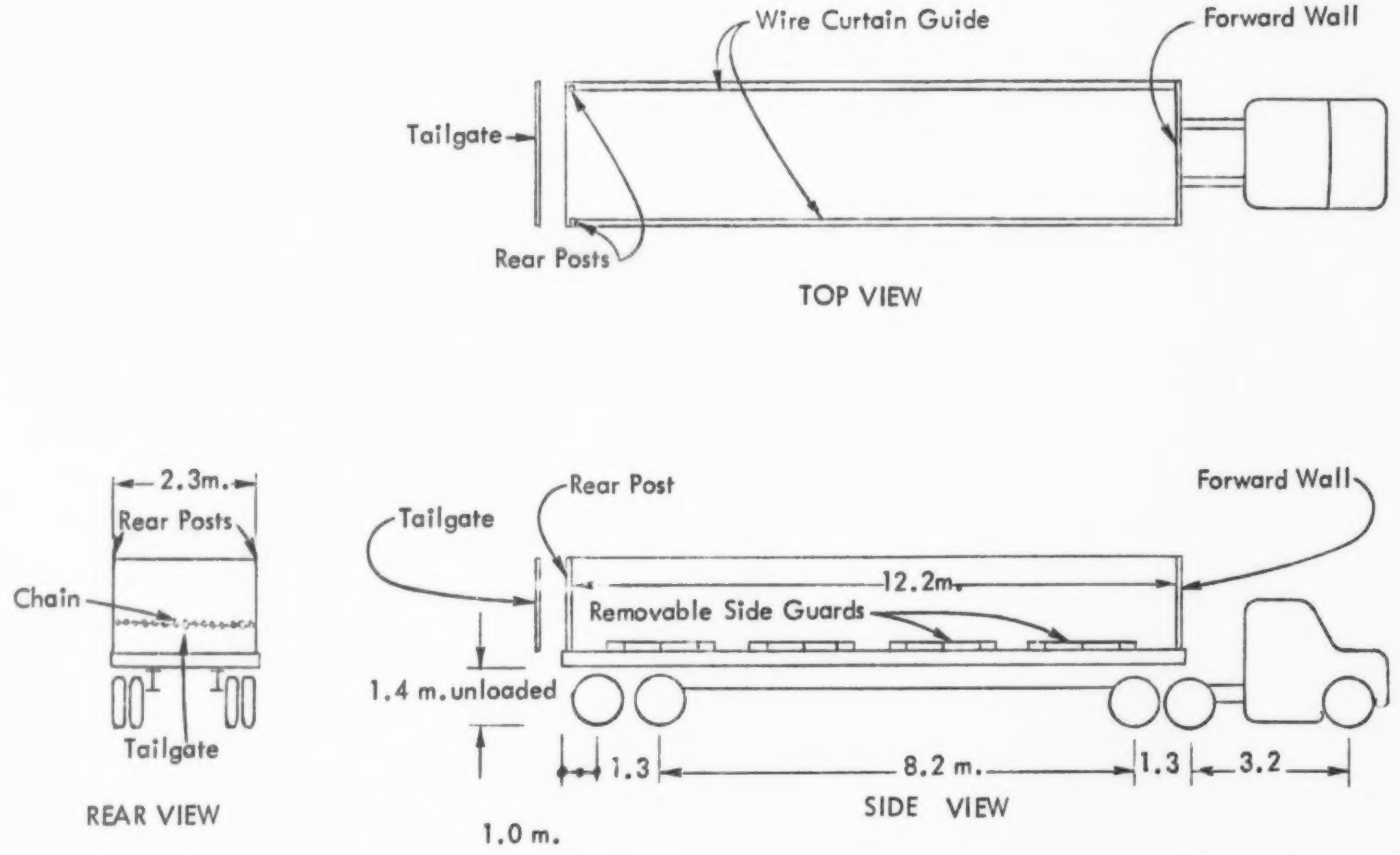
NOTE: Not to scale. Dimensions are
given in meters.

FIGURE D-7
CONVEYOR DETAILS



NOTE: Not to scale.

FIGURE D-3
LOADING DOCK
SCHEMATIC



Not to scale

FIGURE D-9
BALING PLANT TRANSPORT VEHICLE

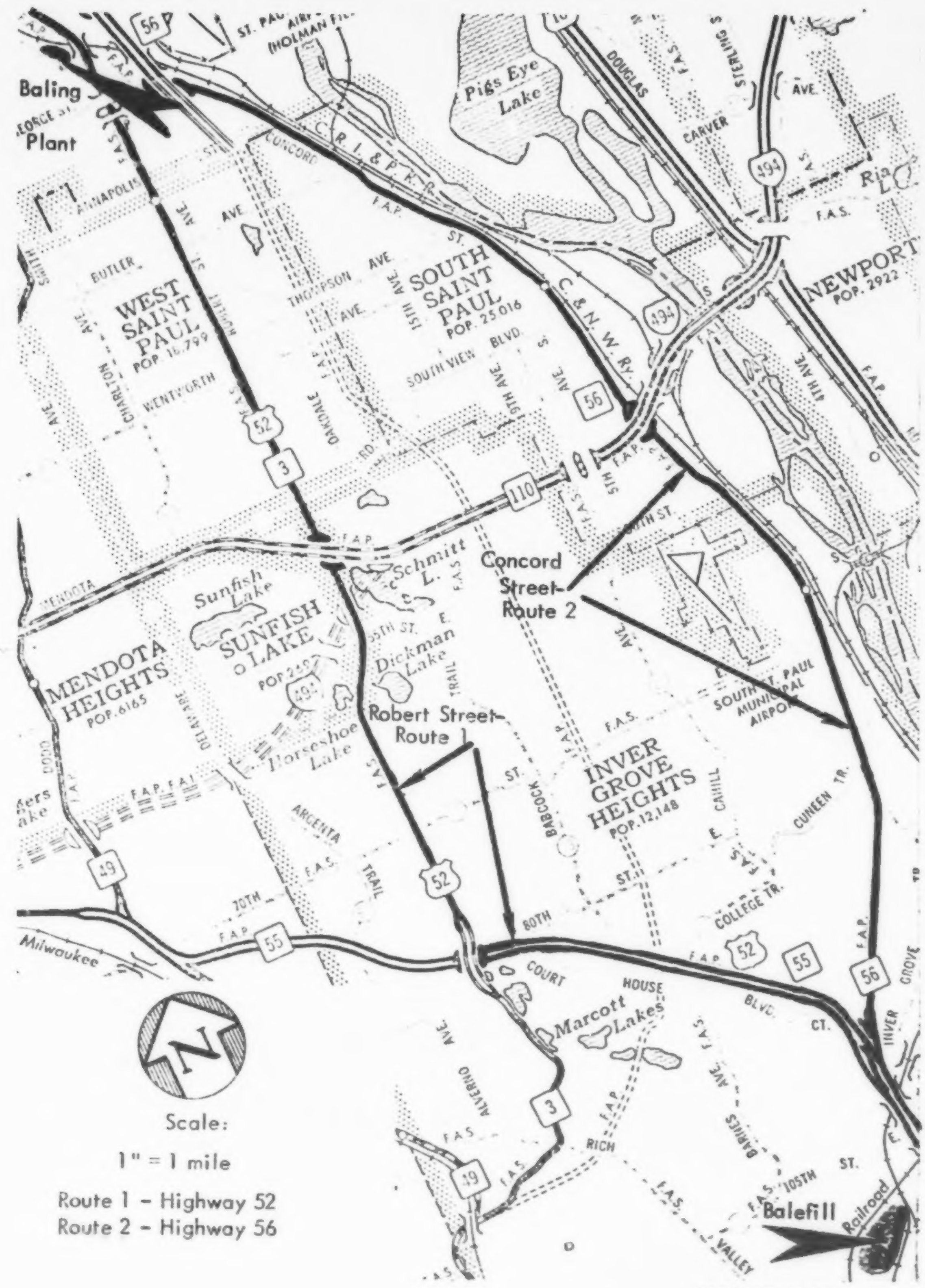
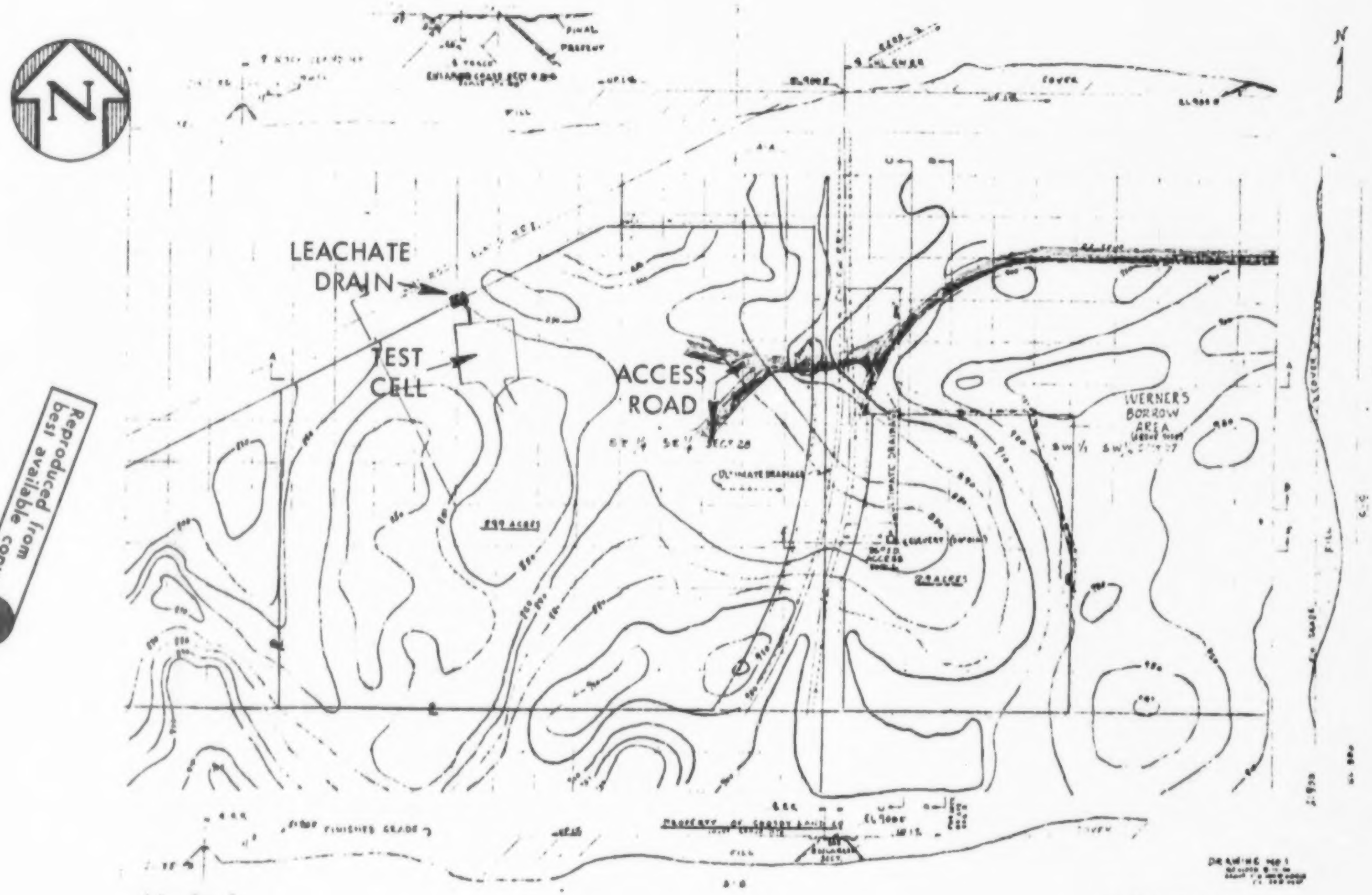


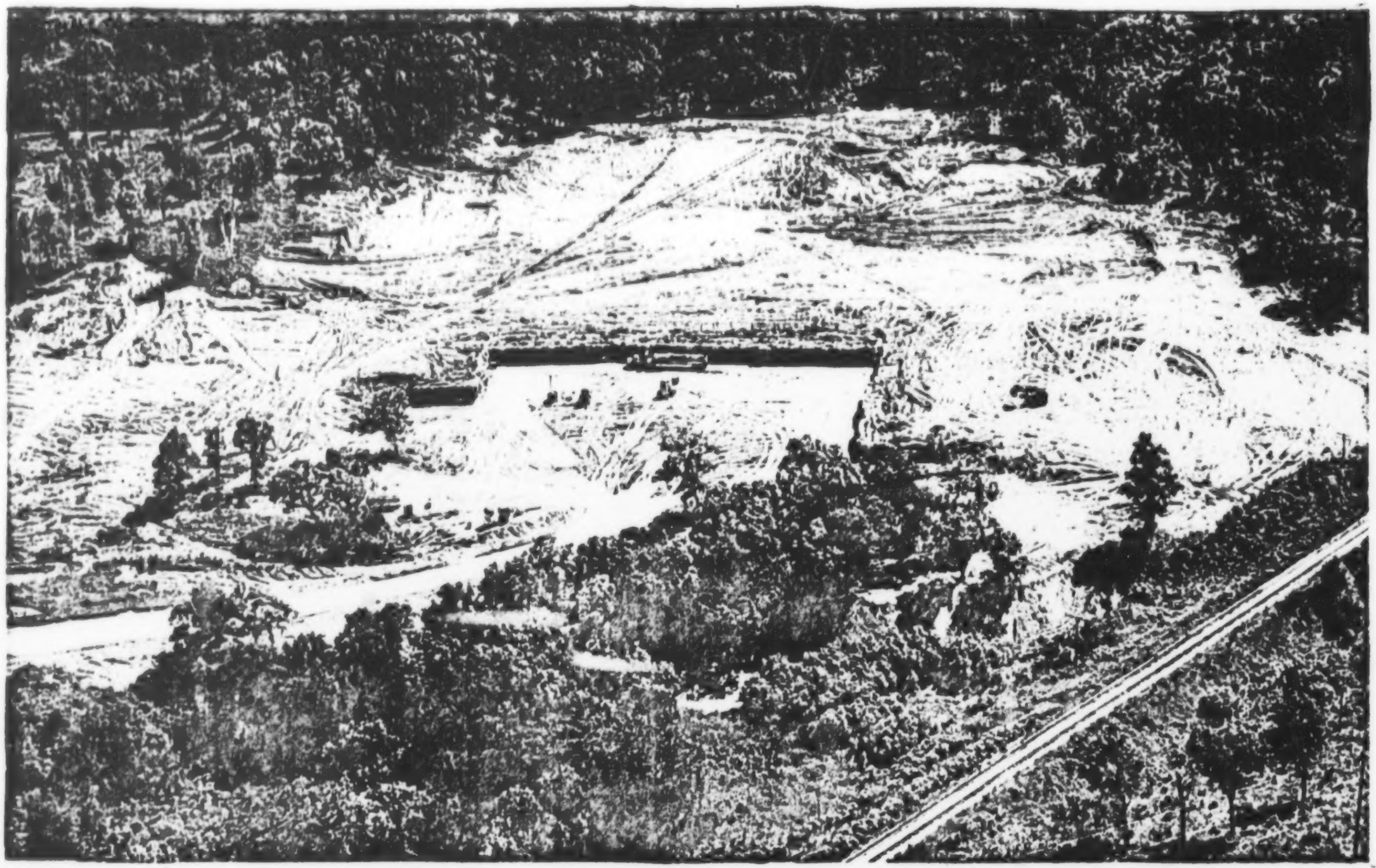
FIGURE D-10
BALE TRANSPORT
TRUCK ROUTE TO BALE FILL



No Scale

FIGURE D-11
BALEFILL TOPOGRAPHY
AND TEST CELL LOCATION

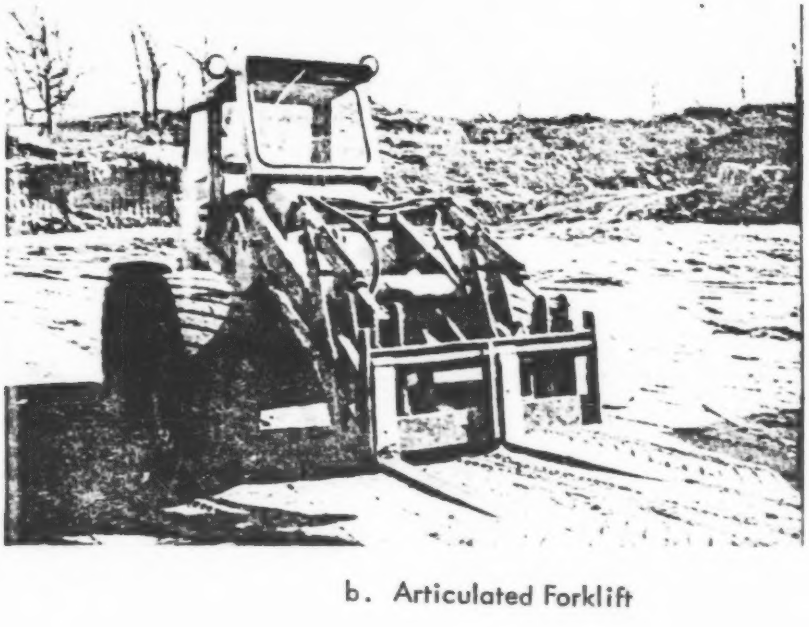
Reproduced from best available copy.



Source: American Hoist

PHOTOGRAPH D-1
BALE PLACEMENT IN
HORIZONTAL TIERS

a. Flatbed Trailer Used
To Haul Bales



b. Articulated Forklift

PHOTOGRAPH D-2
LANDFILL BALE HANDLING
EQUIPMENT

PHOTOGRAPH D-3
COVER SOIL LOADER

APPENDIX E

BALING PLANT SYSTEM AND HUMAN PERFORMANCE ANALYSIS

APPENDIX E

Appendix E details the system and human performance facets of the time and method study, as specified in Section 7. These analyses were the basis for the plant performance evaluation within Section 7.

A. System Performance.

In order to analyze the baler plant, transport net and balefill, eleven machines were defined. Each machine was used in processing solid waste, and each had a network description with average time per state. The eleven machines were the gateman, loader, conveyor, scale, baler, pusher, four transport trucks, and forklift. The machines represented one man and ten items of equipment in the system.

Each machine had a set of defined operating states. The states were complete and sequential in that one and only one state exists for a single machine at each instant. Thus, according to the network model, a machine spends time in a state, shifts instantly to a new state, spends time in the new state, etc. Each sequence of states was constrained.

The gateman and loader were located inside the front door. Together they handled incoming solid waste. The gateman had six defined states that were task-oriented, in that, for example, no mention was made of how he directed the dumping or measured truck volume. The break points between his tasks were those instants when he finished one task or started another, as indicated by his eyes and body movements. The defined operating states of the loader were also task-oriented. The baling plant description illustrates how the loader operates in each state. The break points for loader states were consistent; the stopping of the four wheels, shifting into gear, contact of the bucket with waste, and raising of the bucket were four break points delineating "unload," "return," "travel," "load," "mix," "carry," and "clean floor" states.

The conveyor, scale, baler, and pusher states were identified by control panel lights connected to sensors on these machines. Again, the defined states were task-oriented; Section 2 of this report included machine layouts and other aids for visualizing the physical system. These states identified the processing of the solid waste through the central part of the baling system.

The conveyor had two simple states of "run" and "idle." Idle time was often due to some delay in another machine. The scale was more complex in concept and operation; "load," "idle/loader," "idle/conveyor," "idle/baler," "dump," and "return" states were separately distinguished. During the "load" and "idle/. . ." states the scale platen was in place and possibly locked down to prevent large waste items from jarring the scale load cells. The load time was the time from when the conveyor started a new load cycle until the desired waste charge was measured out, less periods over 0.2 minutes when the conveyor was stopped. Idle time was blamed on interference by other machines; the basic distinction is that idle time while loaded is due to the baler, and idle time while unloaded is due to the loader or conveyor. The baler had a cycle of item states, but the states worked in a simple, steady, repetitive sequence. The states were indicated by panel lights showing the release and application of hydraulic and mechanical locks.

The transports were logged by the two truck drivers as to arrival, departure, gas, repair, and lunch times. The time intervals were labeled "idle/load," "transport," idle/unload," "return," "gas," and "repair." "Rigging" and "lock tailgate" times were stop-watch measured by Ralph Stone and Company, Inc., engineers daily. In the transport truck data presentations, the average time in each state would be that for all four trucks. It can be assumed that at any instant one transport was in each of the four states of "idle/load," "transport," "idle/unload," and "return," as this was usually the case.

The balefill forklift was also timed by stop-watch in "load," "carry," "unload," "position," "return," "travel," "handwork," and "idle" states during weekly monitoring. The breakpoint between most states was marked by the motion of the forklift's wheels. "Return" and "travel" were distinguished by the subsequent state: whether the forklift returned to load another bale or went elsewhere.

At any instant, the processing system was identified by the eleven instantaneous states of the eleven defined machines. Processing time was represented as the average machine cycle time, or as the sum of average state times for the sequence of states used. These times are presented in the following sequence of presentations. The first three parts are basic descriptive summaries of time performance. The later presentations are more sophisticated network models. For the final presentation, average time values are subtotaled by four plant operating conditions of manual or automatic baler control and dry or wet solid waste. This is done to show the stability of the average state processing times under fluctuating conditions.

1. Utilization. Utilization is a statistical measure of the use made of each machine. By definition, the sum of the percent utilization of all machine states is 100 for each machine. Figure E-1 presents state utilization by machine, except those at the balefill.

These values were derived by dividing the average measured time in a defined state per machine cycle by the average measured cycle time of the respective machine. This information was specific to each machine.

The significance of percent utilization lies in comparing design and actual use. Thus, the percent idle time per cycle shows the percent decrease from maximum production. Yet the total lack of idle time in a single machine conversely indicates a bottleneck in production. Both extremes are undesirable.

The utilization of each state signifies the relative time-cost of each operating state. The costliest states will yield the greatest improvements in system performance for a percent improvement in the state performance.

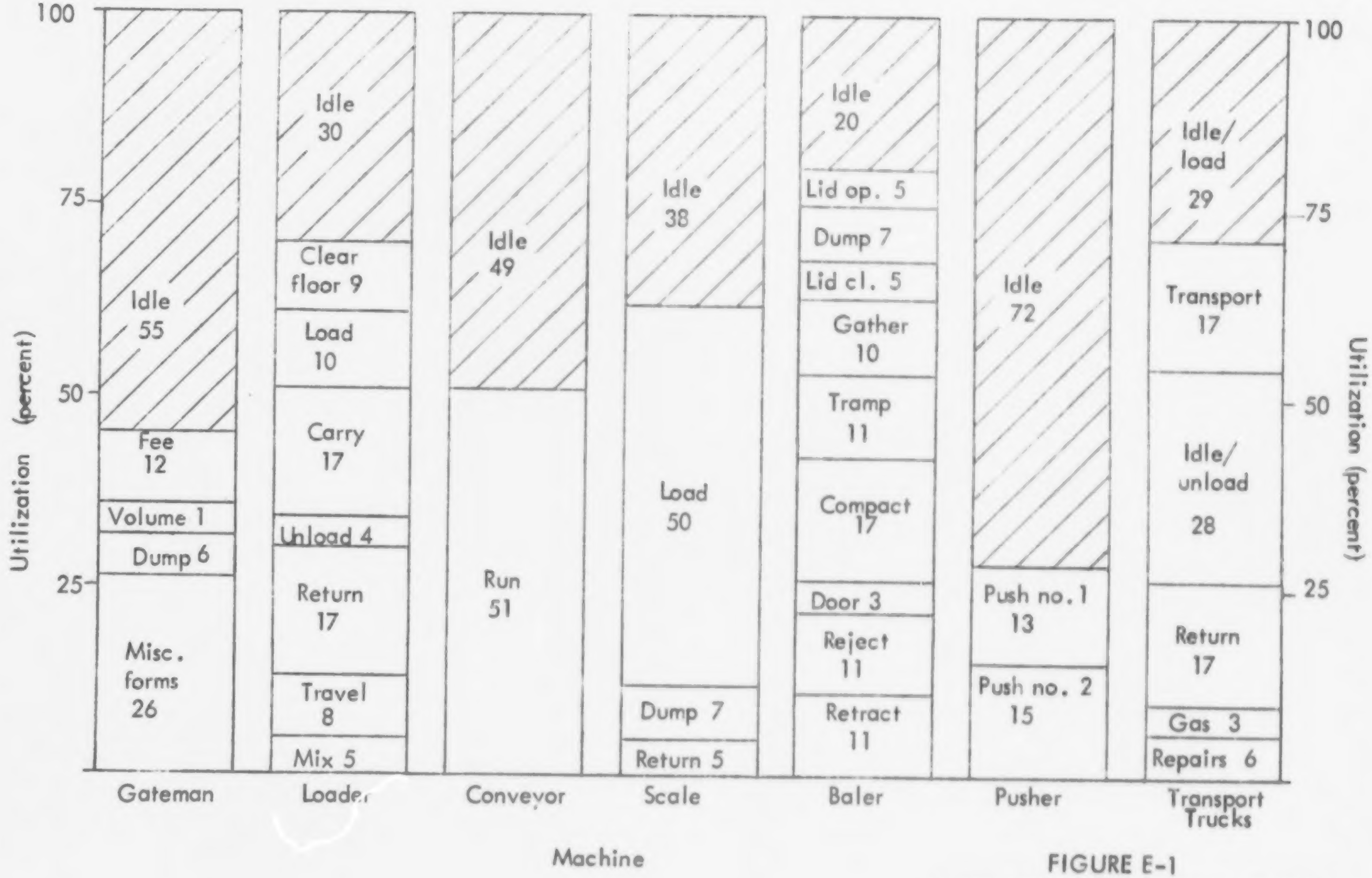


FIGURE E-1
STATE UTILIZATION BY MACHINE
(IN PERCENT)

2. Interference. Interference is a statistical measure of the time one machine waits idle for another machine in the sequence. For example, the baler sometimes waits for the conveyor to load the scale platen and the conveyor sometimes waits for the baler lid to open. In interference terms, the conveyor interferes with the conveyor another time. Thus, A interferes with B for X percent of B's cycle, and B interferes with A for Y percent of A's cycle. This concept can be viewed as blaming some of B's idle time on A, and some of A's idle time on B. This is valid since A was waiting until B finished its operations, and B waited on A at other times. Thus, all of A's and B's idle time can be blamed on the machines in the system.

Table E-1 presents the interference between seven different machines in the plant. Notice the pusher and transports did not interfere with other machines; it is possible for the plant to stop due to the pusher or transport, but this did not occur under measured operating conditions. The gateman was a different case, though, in that he could not interfere with any subsequent machines. The forklift is not considered here since the results would be valid only at St. Paul.

The best-designed machines will interfere due to statistical fluctuations. The pattern of interference is an indicator of conditions. The condition of matched production rates results in matched interference values; in other words, X interferes with Y the same amount that Y interferes with X. The condition of integrated machines in a sequence also results in small interference values for all the machines. At the plant, the machines formed a balanced production system, with the conveyor causing the most interference.

3. Gantt Chart. In order to visualize the dynamic operation of the plant, a Gantt Chart is presented in Figure E-2. The seven defined machines are represented by their operating states for a hypothetical six-minute period of plant operation. The results are considered typical of any six-minute period. Notice that the scale, baler, pusher, and transports were highly structured in their cycles and operating times. The gateman and loader were very unstructured in their cycles; they depended on random incoming trucks and stockpiled solid waste to determine their necessary operations. The conveyor was semistructured, depending on the height of solid waste piled on by the loader operator, with possible stop-starts in the load cycle.

The times on the Gantt Chart are from the average observed times for each state; random number tables were used to choose a specific value for each mean and standard deviation. Basically for each state two numbers from 0 to 99 were picked from a column of random numbers. The first number fixed the sign of the deviation by being greater than or equal to or less than 50. The second number picked the magnitude of the deviation in percent of the confidence level; for example, 1σ is 65 percent, 20 95 percent, and 3σ 99 percent. Notice that normal distributions are assumed in these approximate, but representative, random times.

TABLE E-1
MACHINE INTERFERENCE BY MACHINE

Causing Interference / Interfered with	Gateman	Loader	Conveyor	Scale	Baler	Pusher	Transport
Gateman	----	—	—	—	—	—	—
Loader	10[b]/33	----	—	—	—	—	—
Conveyor	—	4/8	----	11/22	18/37	—	—
Scale	—	3/8	17/45	----	18/47	—	—
Baler	—	3/15	13/65		----	—	—
Pusher	—	3[a]/4	13[a]/18		56/78	----	—
Transport	—	1[a]/3	4[a]/14	24/83	—	----	—

[a] Number follows from previous step.

[b] Estimated from video tape/based on his waiting for trucks and gateman.

$$\boxed{X/Y}$$

$$X = \frac{\text{Average idle time per cycle due to interfering machine}}{\text{Average cycle time of machine being interfered with}}$$

$$Y = \frac{\text{Average idle time per cycle due to interfering machine}}{\text{Average total idle time per cycle of machine being interfered with}}$$

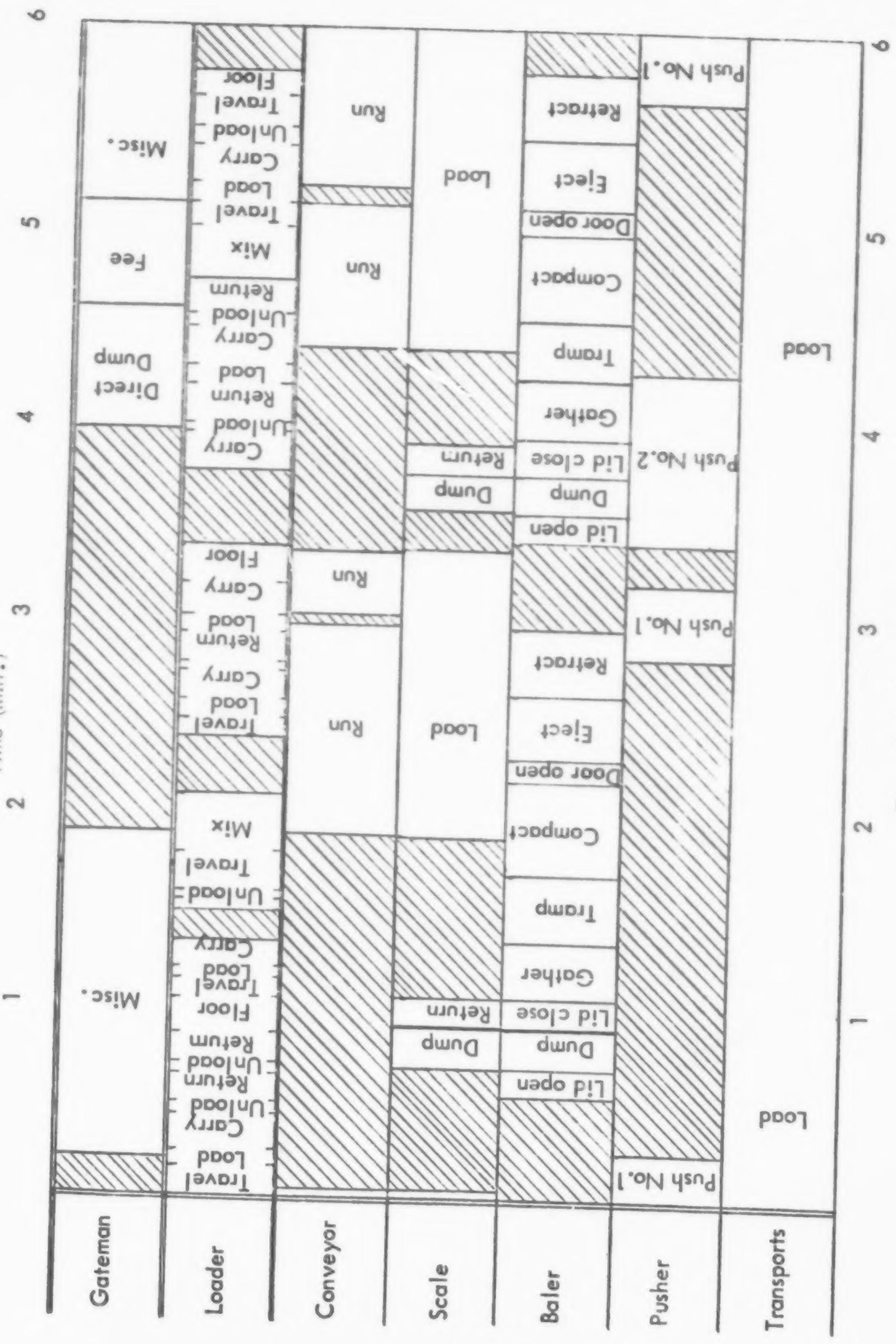


FIGURE E-2
GANTT CHART OF MACHINES

4. Machine Networks. Each machine is described herein as a network of complete sequential states. Mean observed time and standard deviation for each state are listed in the activity networks, Figures E-3 through E-10. These times represent standard times for the defined operations. This is a basis for evaluation and comparison with alternative methods and different systems. These standard times represent the current state-of-the-art in the St. Paul baling plant.

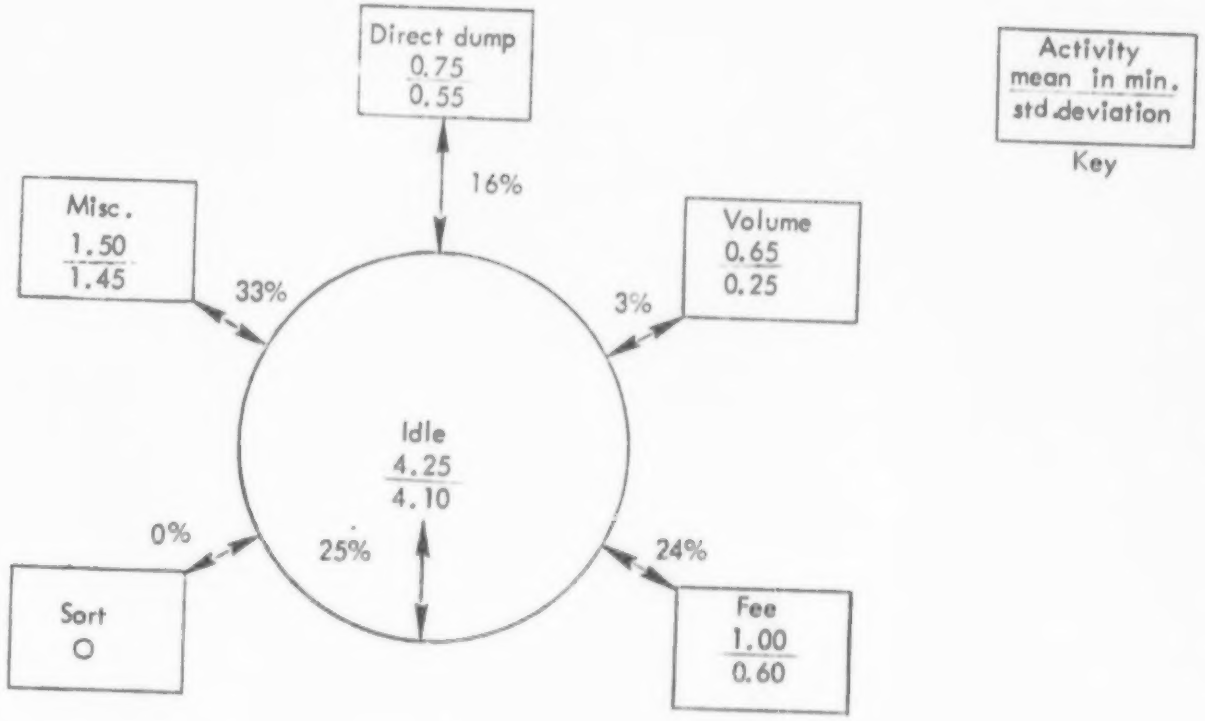
Some machines possess simple network descriptions. Examples are the conveyor, scale, baler, pusher, and transports; these are simple sequential machines with highly structured operations. Conversely, the gateman and loader have complicated network descriptions of their relatively unstructured operations. At the St. Paul baling plant a number of alternative cycle paths was indicative of operating consistency, and the ratio of the standard deviation time over the mean time for any state indicates the time uniformity of that operation over many cycles. For example, some states of the baler were very uniform, such as "lid open" and "lid close;" conversely, the states of the gateman were constantly changing each cycle. The times presented in Figures E-3 through E-9 are based on observations by Ralph Stone and Company, Inc., engineers on September 20 through 28, 1973. The times in Figure E-10 result from long-term field observations over one year.

5. System Network. Table E-2 presents the sequence of operations that solid waste undergoes during processing at the plant. There are 24 defined operations on the solid waste. Operations not performed on solid waste, such as lid opening, are lumped in idle categories. Notice that the times are average observed times per bale. Thus, the times for operations two through six were changed to reflect 2.7 loader-tractor cycles per baler cycle. The time for step one was the average observed time to dump, times the average observed number of trucks, divided by the average observed number of bales. Sections 3 and 4 of this report contain these truck and bale figures. The time waste is stored on the plant floor varied greatly, depending on the rates of incoming solid waste and bale production, but never ran longer than 72 hours, the weekend figure. Usually, solid waste was processed the same day, yielding a storage time of less than 16 hours on the floor. The minimum processing time per unit of solid waste baled, using mean times, was 48.85 minutes.

The reduced plant network in Table E-3 sums up the system performance as twelve distinct operations on the solid waste. This is a general level of activity useful when comparing the existing plant with redesigned plants. The defined operations are the minimum number necessary. Therefore, they are basic to baled solid waste systems rather than specific to the St. Paul plant.

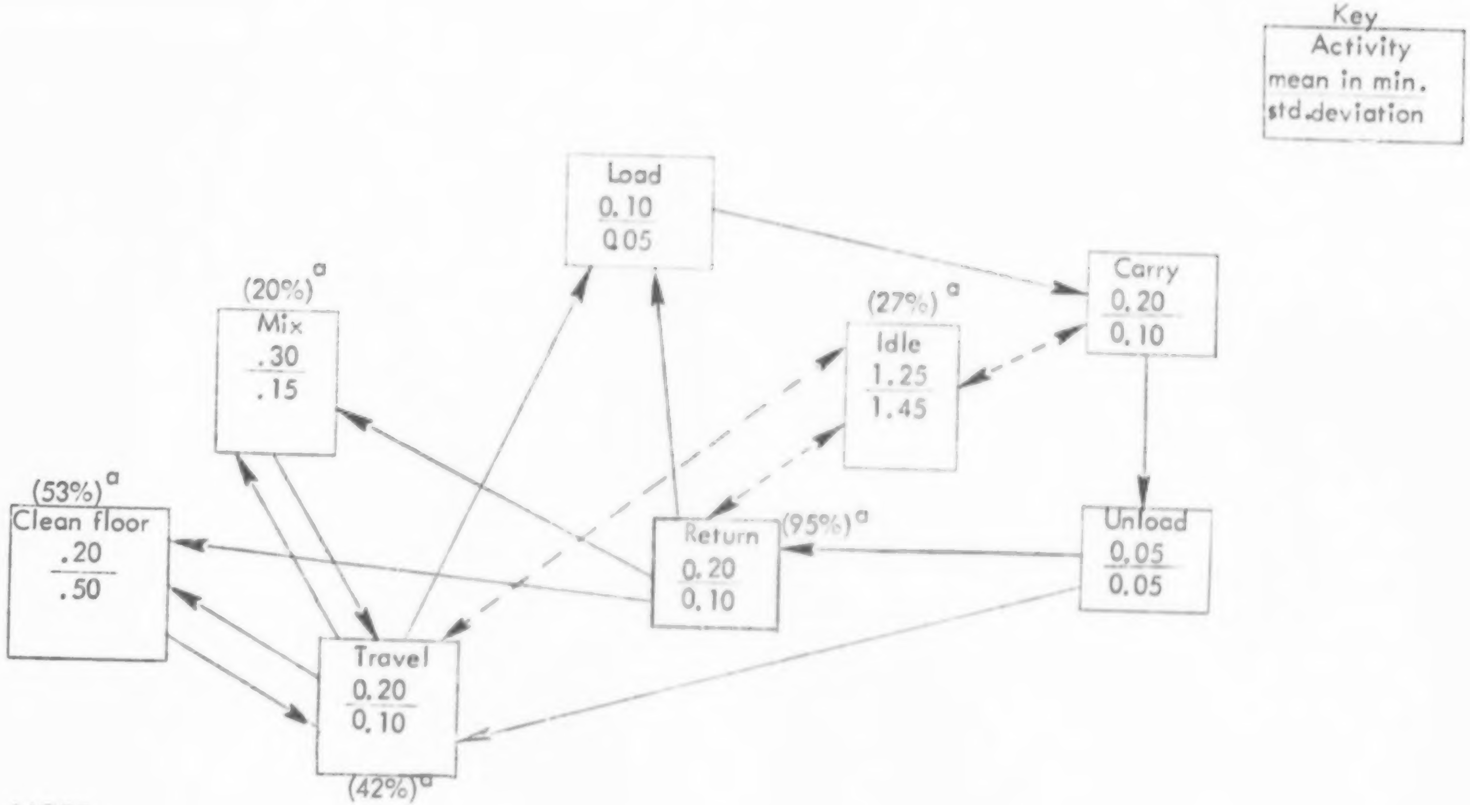
The time values in the two tables follow directly from the observed mean times. Two Ralph Stone and Company engineers measured these times as described below.

6. Movement of Standard Times. The information presented so far has been average times and standard deviations with the resulting percentages, as measured during nine hours of observation. The present discussion presents the observed time data subtotaled by plant conditions and totalled. Tables E-4 through E-7 present the mean times and standard deviations that were used to calculate all previous figures and tables. The standard



NOTE:
Times are average times in minutes to accomplish the task.
Percentages refer to probability in one entire cycle that particular pathway or particular process is employed.

FIGURE E-3
BALING PLANT
GATEMAN ACTIVITY NETWORK



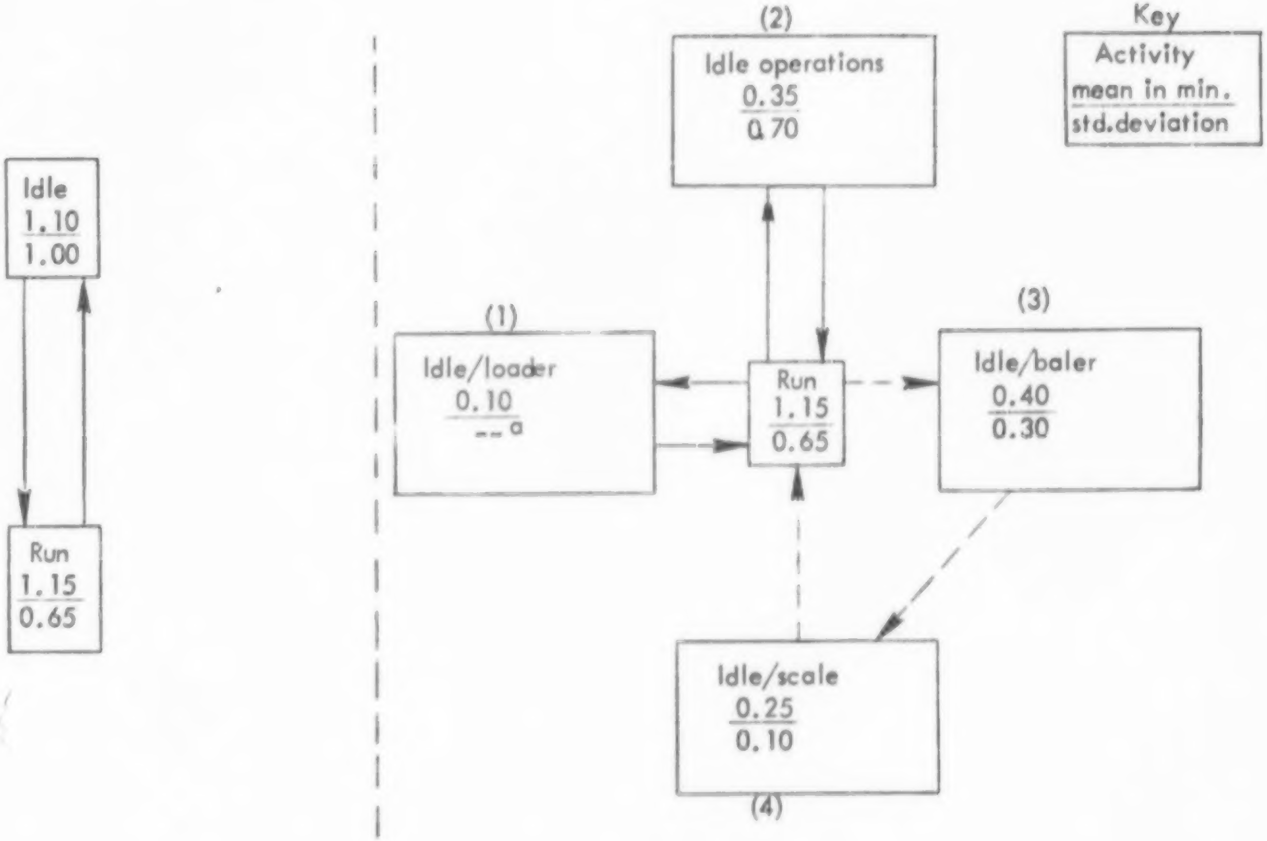
NOTE:

Average cycle time = 1.10 min.

Load cycle time = 0.55 min.

[a] Percentages refer to probability in one entire cycle that particular process or particular pathway is employed.

FIGURE E-4
BALING PLANT
LOADER ACTIVITY NETWORK



NOTE:

Average cycle time = 2.25 min.

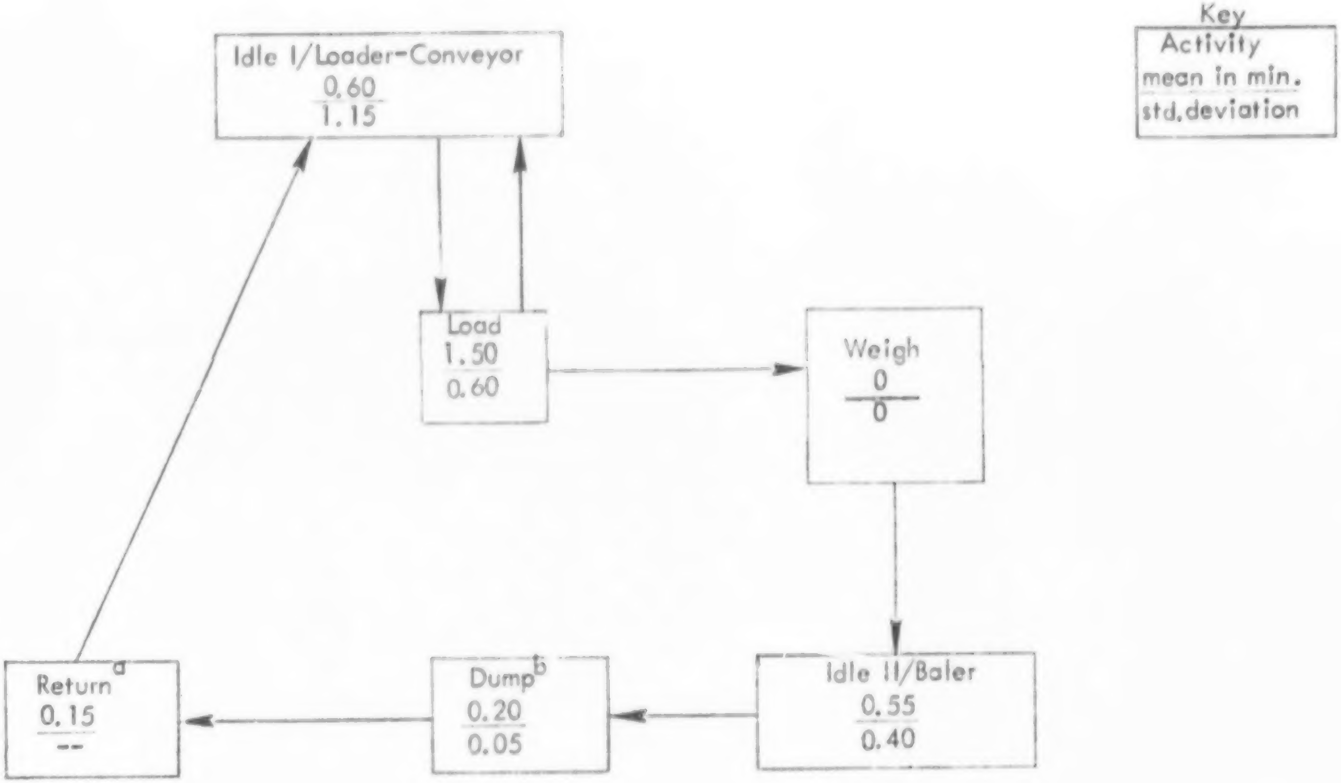
— — — → = at most once per baler cycle.

———→ = possibly many times per baler cycle.

Note that times were averaged per conveyor cycle.

[a] Standard deviation was not computed since the mean was based on only a few occurrences.

FIGURE E-5
BALING PLANT
CONVEYOR ACTIVITY NETWORK



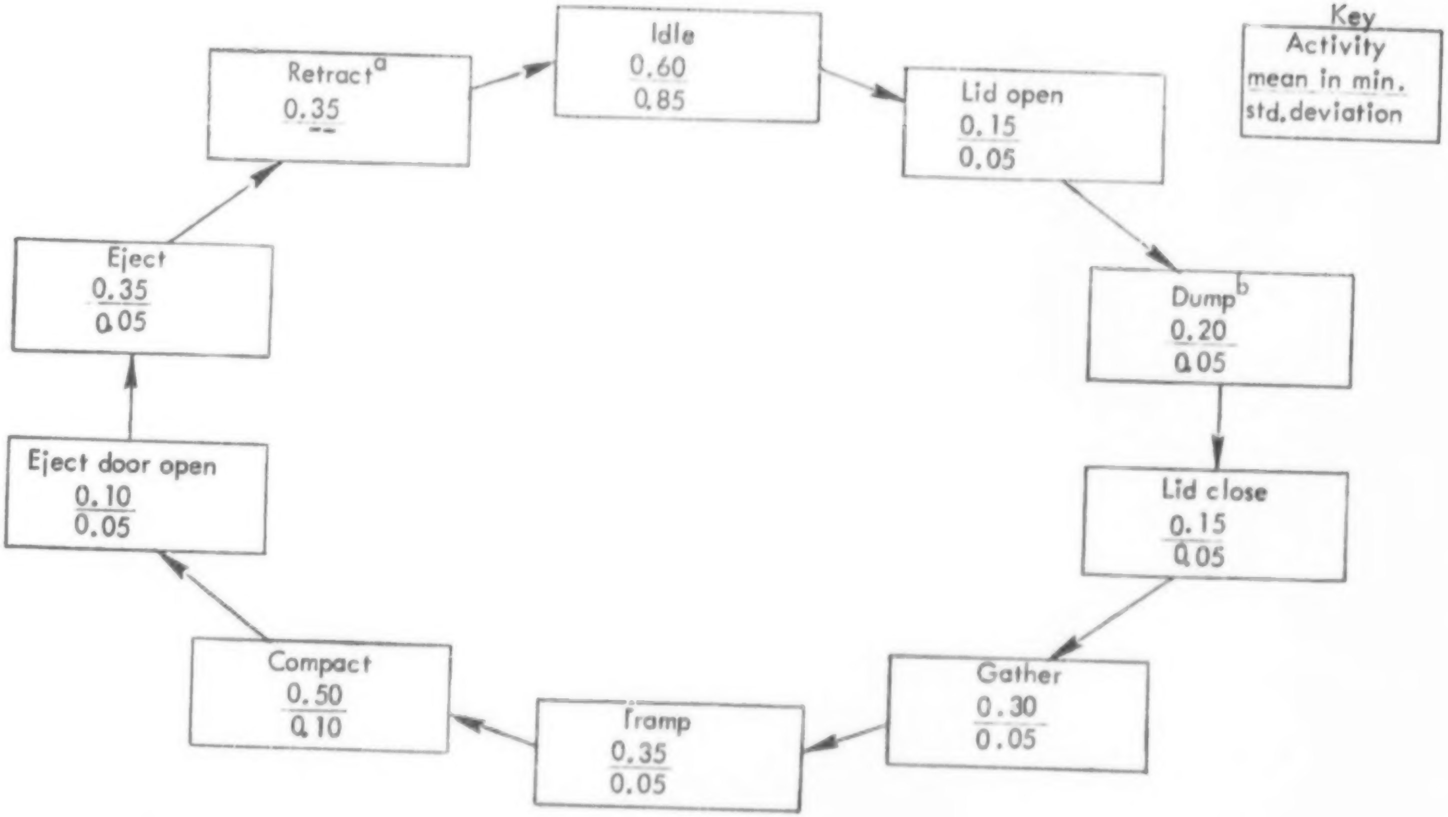
NOTE:

Cycle time = 3.00 minutes.

[a] Estimated from videotapes; data base too small to estimate a standard deviation.

[b] Same as on baler.

FIGURE E-6
BALING PLANT
SCALE ACTIVITY NETWORK



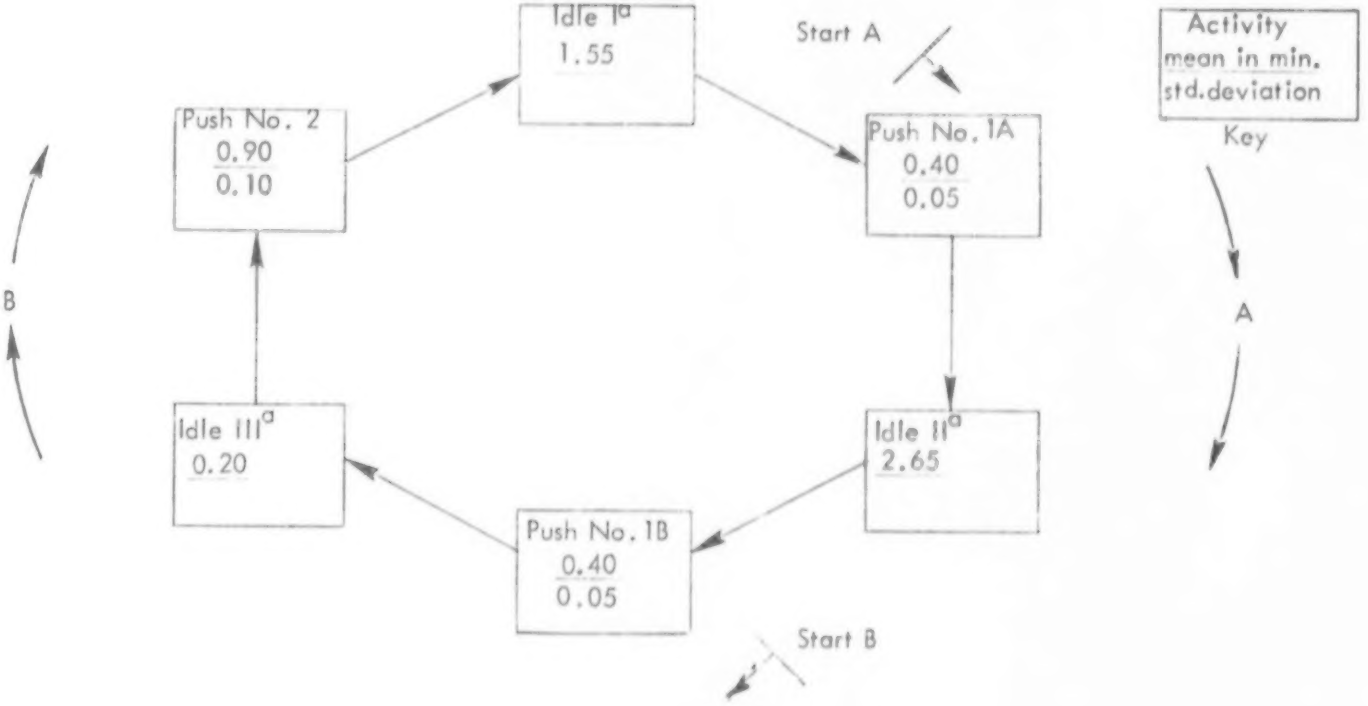
NOTE:

Cycle time = 3.05 minutes.

[a] Estimated from video tapes; data base is too small to estimate a standard deviation.

[b] Same as on scale.

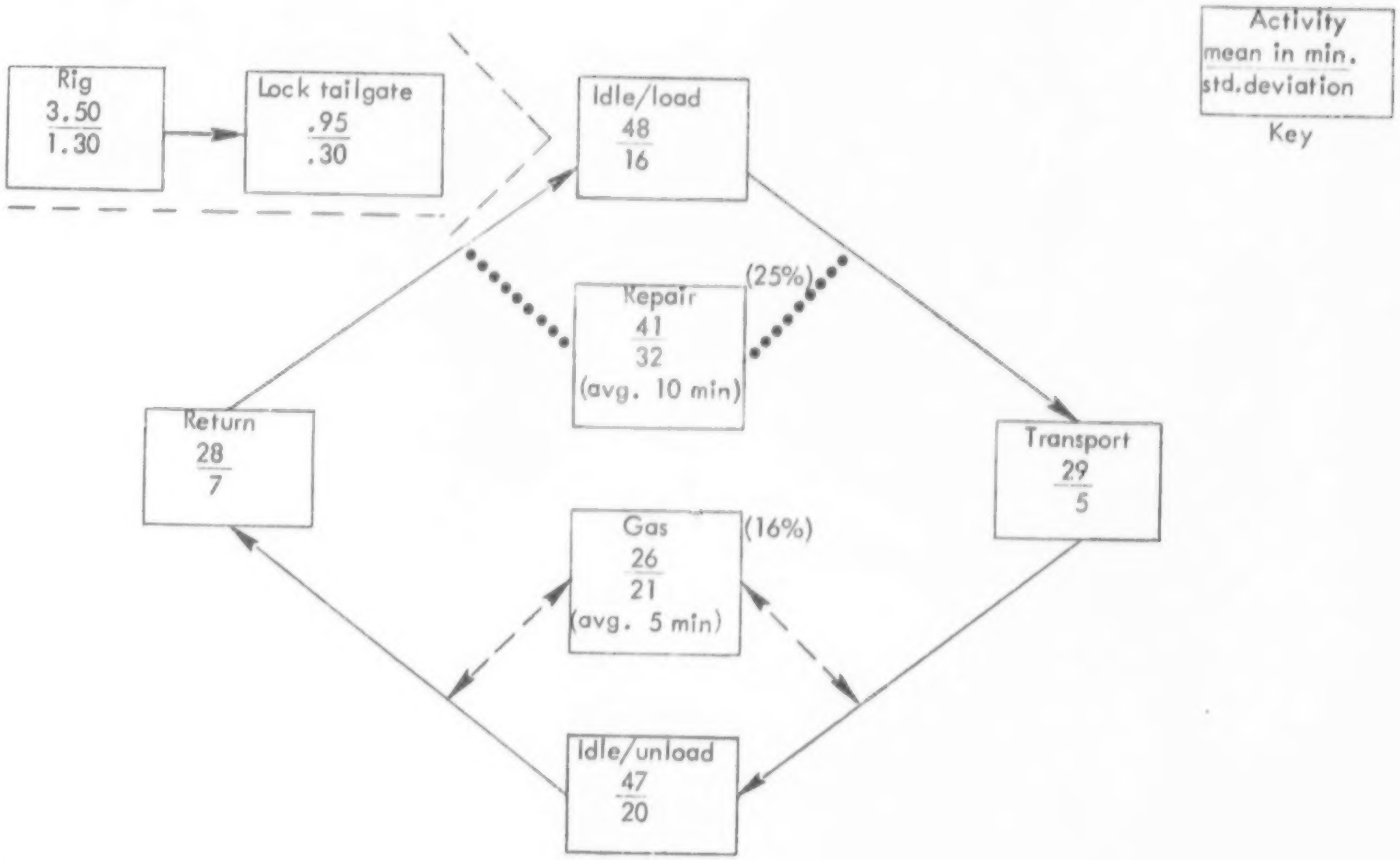
FIGURE E-7
BALING PLANT
BALER ACTIVITY NETWORK



NOTE:
Cycle time = 2 x baler cycle = 6.10 minutes.

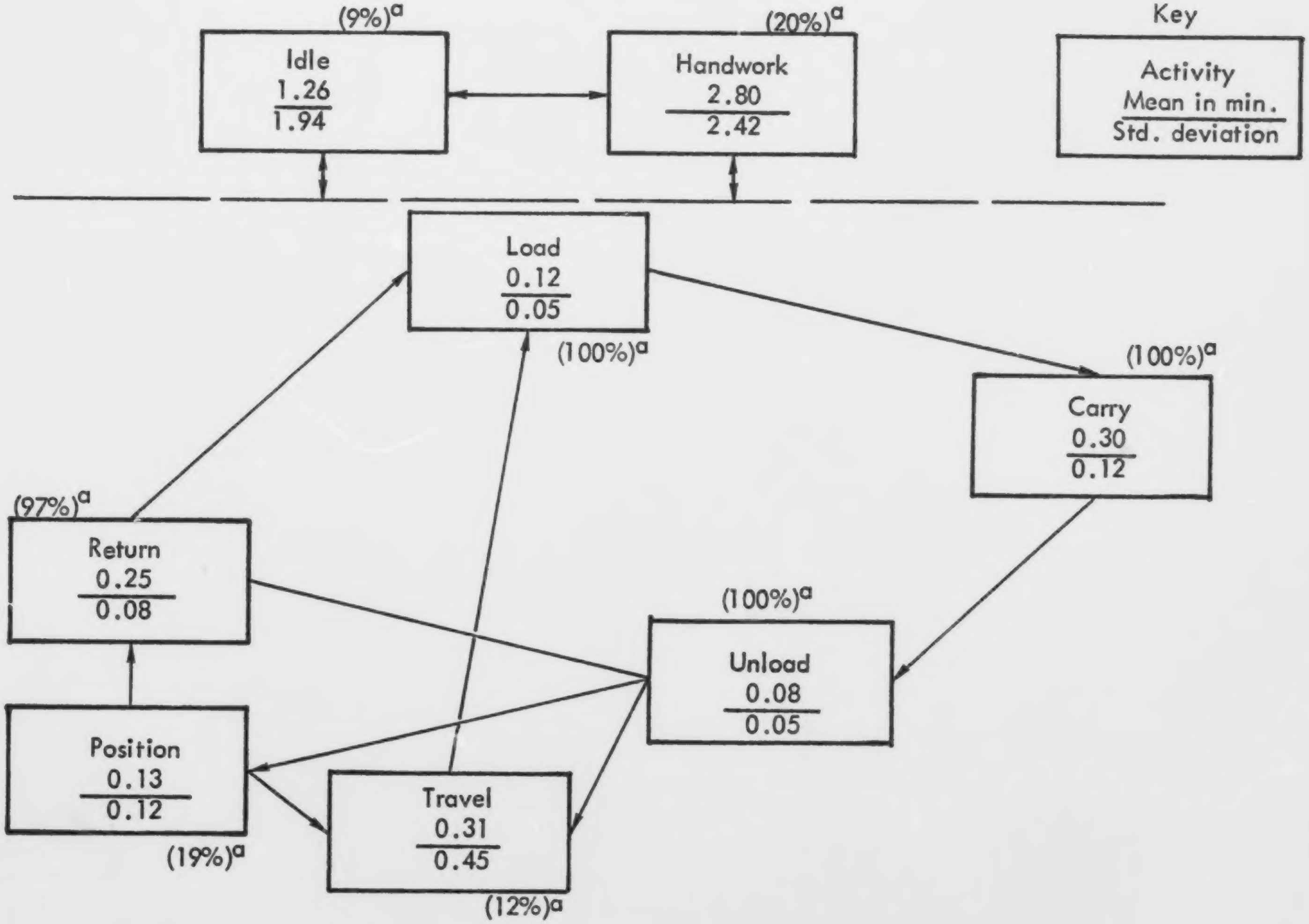
[a] Estimated value from video tape; data base is too small to estimate a standard deviation.

FIGURE E-8
BALING PLANT
PUSHER ACTIVITY NETWORK



NOTE:
Average cycle time = 2 hrs.47 min.
only ——→ = 2 hrs.32 min.
with - - -→ = 2 hrs.58 min.
with ●●●●●●●● = 3 hrs.13 min.
Percentages refer to probability in one entire cycle that particular pathway or particular process is employed.

FIGURE E-9
BALING PLANT
TRANSPORT ACTIVITY NETWORK



Note:
Average cycle time = 1.48 min.
[a]Percent of cycles that included this activity

FIGURE E-10
BALEFILL FORKLIFT
ACTIVITY NETWORK

TABLE E-2
PROCESS SEQUENCE ON UNIT OF SOLID WASTE BALED

Machine	Operation on Solid Waste	Mean Time (min.)
Collection Trucks	0 Enter Plant	0.00
	1 Dump	2.40[a]
Loader	2 Idle on Floor	b
	3 Mix on Floor	0.15
	4 Load Bucket	0.30
	5 Carry	0.55
	6 Unload Bucket	0.15
Scale	7 Setting on Conveyor	12.70[c]
	8 Load Scale	1.50
	9 Idle Waiting on Baler[d]	0.55
	10 Dump into Charging Box	0.20
Baler	11 Lid Close	0.15
	12 Gather	0.30
	13 Tramp	0.35
	14 Compact	0.50
	15 Door Open	0.10
	16 Eject	0.35
Pusher	17 Idle[d]	e
	18 Push No. 1	0.40
	19 Idle[d]	1.85[e]
	20 Push No. 2	0.90
Transport	21 Idle on Truck Bed	21.00
	22 Rig	3.50
	23 Lock Tailgate	.95
	24 Leave Plant	0.00
Total Time From Enter to Leave Plant		48.85 + Step 2

[a] Estimated from video tapes.

[b] Usually less than 16 hours, max. up to 3 days over weekend.

[c] Estimated from 39 meters of travel at 6 meters per minute, with idle percent at 49 for conveyor.

[d] Waiting on lid to open, runs to retract, and possibly other baler operations.

[e] Sum of 17 and 19 is 1.85, averaged for two bales.

TABLE E-3

REDUCED BALED SOLID WASTE NETWORK

	Operation	Cycles Per Baler Cycle	Average Process Times (min.)	
			Per Bale	Per 1,000 Kilograms
(1)	Dump on Floor	-	2.40[a]	1.90
(2)	Store/Mix	-	-	-
(3)	Load Conveyor	2.8	1.50	1.20
(4)	Convey	1	3.00	2.35
(5)	Measure Charge	1	0.05	0.04
(6)	Bale	1	3.05	2.40
(7)	Load Trailer	0.5	3.15	2.50
(8)	Wait on Trailer	0.07	21.0	16.5
(9)	Transport	-	2.0	1.6
(10)	Wait on Trailer	-	25.0	19.7
(11)	Stack	-	-	-
(12)	Cover	-	-	-

[a] Estimated from video tapes.

TABLE E-4
MOVEMENT OF STANDARD TIMES (MINUTES) FOR GATEMAN AND LOADER

	Days	9 - 20/21			9 - 24/28			9 - 25			9 - 24/26			Total		
	Columns	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S. D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.
Gateman	Idle	8	4.20	3.20	10	5.05	5.15	9	3.55	3.80	9	4.15	4.65	36	4.25	4.10
	Volume	0		--	0	--	--	1	0.60	0.60	3	0.70	0.40	4	0.65	0.25
	Fee	4	0.75	0.75	12	1.10	0.60	6	0.90	0.55	13	1.10	0.70	35	1.00	0.60
	Direct dump	3	0.80	0.55	8	0.70	0.30	4	0.80	0.50	8	0.80	0.65	23	0.75	0.55
	Sort	0	--	--	0	--	--	0	--	--	0	--	--	0	--	--
	Misc.	9	2.35	1.70	12	1.50	1.10	11	1.70	1.30	16	0.80	0.55	48	1.50	1.45
		N	$\overline{X}$	S.D.	N	$\overline{X}$	S. D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.
Loader	Machine Idle[a]	6	1.00	0.10	27	1.00	1.60	13	0.70	0.75	17	2.00	5.00	63	1.25	1.45
	Idle	6	1.00	0.10	13	1.30	1.60	8	0.90	0.70	16	2.10	5.00	43	1.50	3.05
	Sort	0	--	--	12	0.60	0.30	5	0.45	0.25	0	--	--	17	0.60	0.25
	Maint.	0	--	--	2	1.45	0.05	0	--	--	1	0.30	--	3	1.30	0.25
	Clear floor	47	0.35	0.40	38	0.30	0.45	24	0.25	0.20	13	0.40	0.45	122	0.20	0.50
	Load	54	0.10	0.10	78	0.10	0.05	60	0.15	0.10	55	0.10	0.05	247	0.10	0.05
	Carry	46	0.25	0.10	71	0.20	0.10	62	0.20	0.15	43	0.15	0.10	222	0.20	0.10
	Unload	53	0.05	0.05	67	0.10	0.05	60	0.05	0.05	52	0.05	0.05	232	0.05	0.05
	Return	51	0.15	0.05	69	0.20	0.10	59	0.20	0.10	44	0.15	0.05	223	0.20	0.10
	Travel	29	0.20	0.15	28	0.20	0.10	20	0.20	0.10	21	0.20	0.10	98	0.20	0.10
	Mix	5	0.40	0.20	16	0.30	0.15	11	0.25	0.10	12	0.25	0.10	45	0.30	0.15

[a] Sum of idle/sort/maint.

TABLE E-5

MOVEMENT OF STANDARD TIMES (MINUTES)
FOR CONVEYOR AND SCALE

	Days	9 - 20/21			9 - 24/28			9 - 25			9 - 24/26			Total		
	Columns	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.
Conveyer	Idle[a]	28	0.75	0.60	36	0.95	0.55	30	1.00	0.55	29	1.65	--	123	1.10	1.00
	Idle/loader	0	--	--	34	0.10	0.45	0	--	--	30	0.30	--	123	0.10	--
	Idle/scale	29	0.25	0.10	34	0.30	0.10	30	0.30	0.10	30	0.30	0.10	123	0.25	0.10
	Idle/baler	29	0.25	0.20	34	0.30	0.25	30	0.35	0.30	30	0.65	0.20	123	0.40	0.30
	Run	32	1.20	0.70	33	1.45	0.75	29	1.10	0.50	31	0.90	0.35	125	1.15	0.65
	Columns	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.
Scale	Idle[a]	21	0.75	0.60	30	0.95	0.75	23	1.05	0.55	23	1.75	--	97	1.15	1.20
	Idle/ loader	0	--	--	34	0.10	0.45	0	--	--	23	0.40	--	97	0.10	0.95
	Idle/convey.	21	0.40	0.35	30	0.45	0.05	23	0.55	0.20	24	0.50	0.25	97	0.50	0.20
	Idle/baler	21	0.35	0.25	31	0.40	0.30	23	0.60	0.35	22	0.85	0.40	97	0.55	0.40
	Load	21	1.75	0.50	29	1.65	0.65	23	1.35	0.25	22	1.25	0.70	95	1.50	0.60
	Dump[b]	22	0.20	0.05	33	0.20	0.05	25	0.20	0.05	25	0.15	0.05	105	0.20	0.05
	Return[c]	--	0.15	--	--	0.15	--	--	0.15	--	--	0.15	--	--	0.15	--

[a] Sum of idle/loader/conveyor/baler.

[b] Same as baler.

[c] Not directly measured.

TABLE E-6
MOVEMENT OF STANDARD TIMES (MINUTES) FOR BALER AND PUSHER

Days	9 - 20/21			9 - 24/28			9 - 25			9 - 24/26			Total		
Columns	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.
Idle	22	0.35	0.60	30	.60	0.80	22	0.35	0.15	20	0.85	1.45	94	0.60	0.85
Idle/loader	0	--	--	30	.10	0.45	0	--	--	22	0.30	--	104	0.10	0.70
Idle/conveyor	0	--	--	30	.50	0.45	0	--	--	22	0.50	0.55	104	0.40	0.55
Idle/operator	22	0.35	0.60	0	--	---	22	0.35	0.15	0	--	--	104	0.10	0.20
Lid open	23	0.15	0.05	32	.15	0.05	24	0.10	0.05	25	0.15	0.05	104	0.15	0.05
Dump^c	22	0.20	0.05	33	.20	0.05	25	0.20	0.05	25	0.15	0.05	105	0.20	0.05
Lid close	22	0.15	0.05	33	.10	0.05	24	0.15	0.05	25	0.15	0.10	104	0.15	0.05
Gather	22	0.30	0.05	31	.35	0.05	24	0.30	0.05	27	0.30	0.10	104	0.30	0.05
Tramp	21	0.35	0.05	29	.35	0.05	23	0.35	0.05	26	0.35	0.05	99	0.35	0.05
Compact	21	0.50	0.10	28	.50	0.10	23	0.55	0.05	22	0.50	0.15	94	0.50	0.10
Eject door open	22	0.10	0.05	26	.10	0.25	23	0.10	0.05	22	0.10	0.05	93	0.10	0.05
Eject	22	0.35	0.05	29	.40	0.10	23	0.35	0.05	21	0.40	0.05	95	0.35	0.05
Return^b	--	0.35	--	--	.35	--	--	0.35	--	--	0.35	--	--	0.35	--

Columns	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.
Idle^a	--	--	--	--	--	--	--	--	--	--	--	--	--	2.20^b	--
Idle I^a	--	--	--	--	--	--	--	--	--	--	--	--	--	1.55^b	--
Idle II^a	--	--	--	--	--	--	--	--	--	--	--	--	--	2.65^b	--
Idle III^a	--	--	--	--	--	--	--	--	--	--	--	--	--	.20^b	--
Push No. 1	15	0.45	0.10	28	0.40	0.05	18	0.40	0.05	18	0.40	0.05	79	0.40	0.05
Push No. 2	6	0.90	0.10	12	0.90	0.05	9	0.85	0.10	8	0.90	0.10	35	0.90	0.10

[a] Not directly measured.

[b] Estimate.

[c] Same as scale.

TABLE E-7

MOVEMENT OF STANDARD TIMES (MINUTES) FOR TRANSPORTS

	Days	9 - 20/21			9 - 24			9 - 25			9 - 26			Total		
	Columns	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.
Transports	Idle/load	15	46	12	16	47	15	19	46	14	11	54	21	61	48	16
	Transport	24	30	4	19	29	7	21	29	4	13	30	2	77	29	5
	Idle/unload	18	42	25	18	40	17	20	50	16	11	55	18	67	47	20
	Return	24	26	4	19	31	2	21	27	3	13	27	2	77	28	7
	Gas	1	20	--	7	28	25	1	10	--	3	28	18	12	26	2
	Repair	9	34	29	0	--	--	5	58	37	1	23	--	15	41	32
	Rig	8	3.85	0.70	7	3.95	1.60	4	2.20	0.90		a		19	3.50	1.30
	Lock tailgate	5	0.95	0.25	5	1.15	0.25	5	0.85	0.35				15	0.95	0.30

[a] 9/25 figures are sum of 9/25 and 9/26.

times and percentages are averages of over nine hours of observation recorded on activity charts.

In order to measure how much the plant operation usually varied each day, the data were subtotalled into four groups. The four subtotals are for four different conditions. Group one on 9/20 and 9/21 is for automatic control and dry waste; group two on 9/24 and 9/28 is for automatic control and wet waste; group three on 9/25 is for manual control and moist waste; and group four is manual control and wet waste. Tables E-4 through E-7 present these subtotals, as well as the totals presented previously.

The four groups cover four disparate conditions, but other possible conditions were not included in the present data. A fuller view must include downtime, described in the subsequent section of this report on maintenance. This time and method study measured operating conditions, not the downtime conditions. It should be understood that these standard times are for the running system; no conclusion is drawn to how long machines run between breakdowns.

Figures 4-1 and 4-2 show the time that every 10th and 25th bale was produced on the days of September 20th to 26th. On any given day, the production rate varied due to the effects of breakdown and changing conditions, such as fatigue and incoming waste composition.

B. Human Performance.

This section presents information on present human performance at five full-time positions. These positions are production jobs: gateman, loader operator, control tower operator, transport driver, and sorter. Notice that four positions were not studied: superintendent, balefill lift operator, maintenance man, and plant forklift operator. The five positions studied are general to baled solid waste system design. The superintendent, maintenance man, and plant lift operator are not integral to the baler production system.

This information is presented as defined tasks, sub-tasks, skills, and human factors. Based on official job descriptions and actual observations, each position had a set of responsibilities or tasks. In order to perform these defined tasks, a man performed a sequence of subtasks, providing detailed performance descriptions. This is a macromotion level of analysis in that many micromotions of a man's body are lumped together. Activity Charts I-A and I-B (see Appendix A) and videotapes were used to develop standard times. Based on the observed behavior and environment of each position, needed skills and human factors were identified.

Tasks were divided into production, information, and safety categories. This distinction between meaningful areas allows positions to be compared and methods to be redefined. Subtasks divided each task into a network of meaningful operations that reflect physical activity. At the subtask level, standard times were given.

Skills were divided into physical, mental, and task skills. This is a natural distinction allowing specifications of a position in these terms. Basically, strength, endurance, visual acuity, hearing, and muscular control were physical characteristics listed as skills. Ability to read, knowledge of machines and procedures, and understanding of work environment were basic mental skills. Task skills were defined as the ability to perform the stated tasks in the standard times with the stated results. Physical and mental skills were general abilities usually present before employment, while tasks' skills would be developed for specific positions during employment.

Human factors are factors affecting production, part of the man-machine interface. Human factors were divided in this discussion into areas affecting perception, machine control, fatigue, and wasted motion. For example, instrument meter location and design had human factors in all four areas; scale precision, force size, numbering, distance from operator, and location relative to other items are factors improving or hindering operator performance. Since labor is a relatively expensive and sensitive, yet powerful tool for production, human factors must be identified and considered in the system design. Human factors were identified for each position.

1. Gateman. Tasks, subtasks, skills, and human factors for the gateman are described below. These tasks divided this position's activity into areas of production, information, and safety. Tasks relating to maintenance and other areas were not defined for two reasons: first, these were minor activities with few controls and little conscious effort; and second, these areas of responsibility were specific to just one set of conditions, subject to many changes.

a. Tasks. A gateman worked on each shift; his job description included responsibility for checking customer credit, filling out data on each ticket, taking money from customers without charge accounts, filing cash and charge tickets, managing incoming waste truck movements, cleaning gate area, and reclaiming pallets and metal.

Table E-8 lists the gateman's tasks and subtasks in production, information, and safety categories. The times are mean times measured from video tapes and Activity Chart 1-A. Gateman task movement is illustrated in Figure E-11. In actual performance the gateman did not work in a set sequence. Depending on many factors, he may not have directed a specific truck into the dump area. Thus, incoming trucks were completely or partially directed to their dumping point; this depends on whether the gateman was already busy, the truck driver was experienced at the baler plant, or the loader operator saw the truck waiting outside. As in the task "directing dump," the safety task of watching the front floor area was only a partially completed task. Thus, at times, the gateman missed the activity on the floor, but when possible he monitored activity to avoid collisions and helped organize the solid waste piles on the floor.

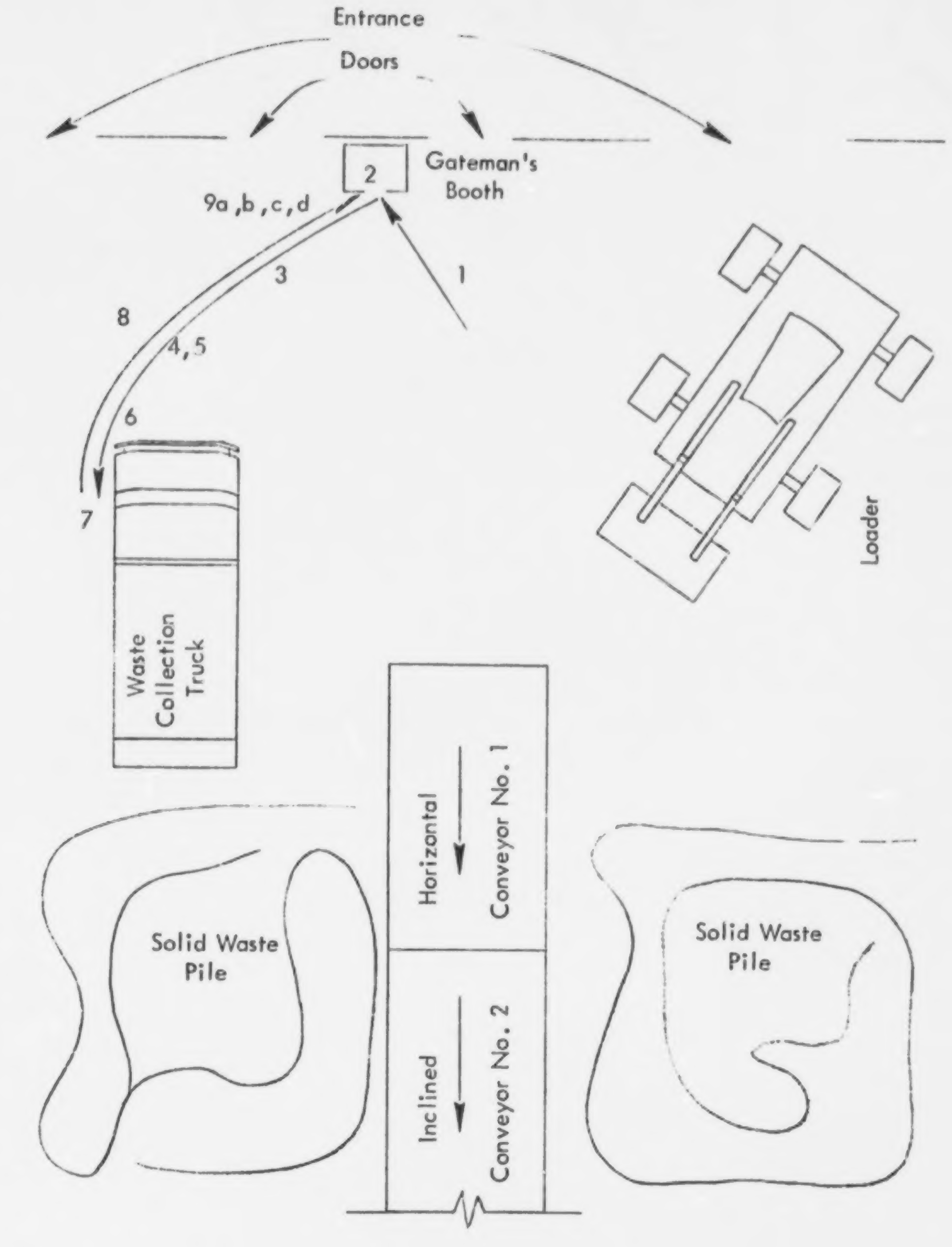
The activity of the gateman was largely dependent on the distribution of vehicle arrivals. Figures E-12 and E-13 show daily and weekly arrival distributions during the survey period. Figure E-14 shows the distribution of arrivals by vehicle size.

TABLE E-8
GATEMAN TASKS

	Task Time (min.)	
Production Tasks:	Mean	Std. Dev.
A. Direct dump	0.75	0.55
1. Guide to door	-	b
2. Guide through door	-	b
3. Direct loader clear	-	b
4. Guide to stop	-	b
Information Tasks:		
B. Charge fee	1.10	0.60
1. Walk to booth	0.20	-
2. Obtain ticket	0.05	-
3. Walk to front of truck	0.15	-
4. Estimate volume (12 percent)[a]	0.65	0.25
5. Fill in vehicle data	0.25	-
6. Walk to cab	0.05	-
7. Charge fee & driver sign	0.30	-
8. Walk to booth	0.20	-
9a. Record transaction		
9b. Make change[a]		
9c. File ticket	0.05 or	-
9d. Walk to truck[a]	0.30[a]	-
9e. Give change[a]		
C. Prepare tickets	1.50	1.45
1. Walk to booth	-	b
2. Fill in dates	-	b
Safety Tasks:		
D. Monitor front floor	Continuously	
1. Monitor incoming trucks	-	b
2. Monitor loader tractor	-	b

[a] Special subtasks for private vehicles.

[b] Unobserved or highly random times.



NOTE:
All inside building.

FIGURE E-11
GATEMAN MOVEMENTS
DURING FEE COLLECTION

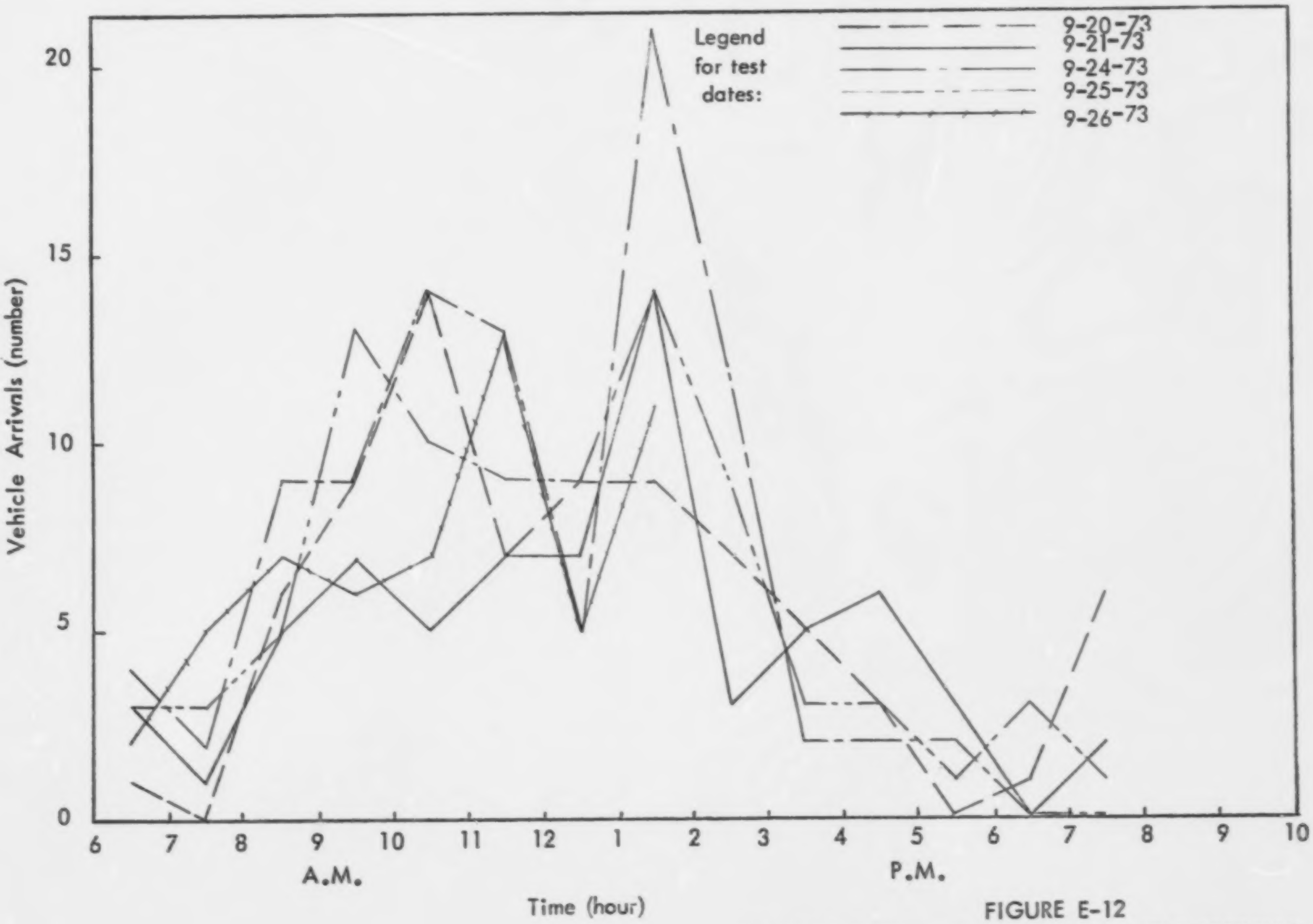


FIGURE E-12
DAILY DISTRIBUTION OF WASTE VEHICLE ARRIVALS

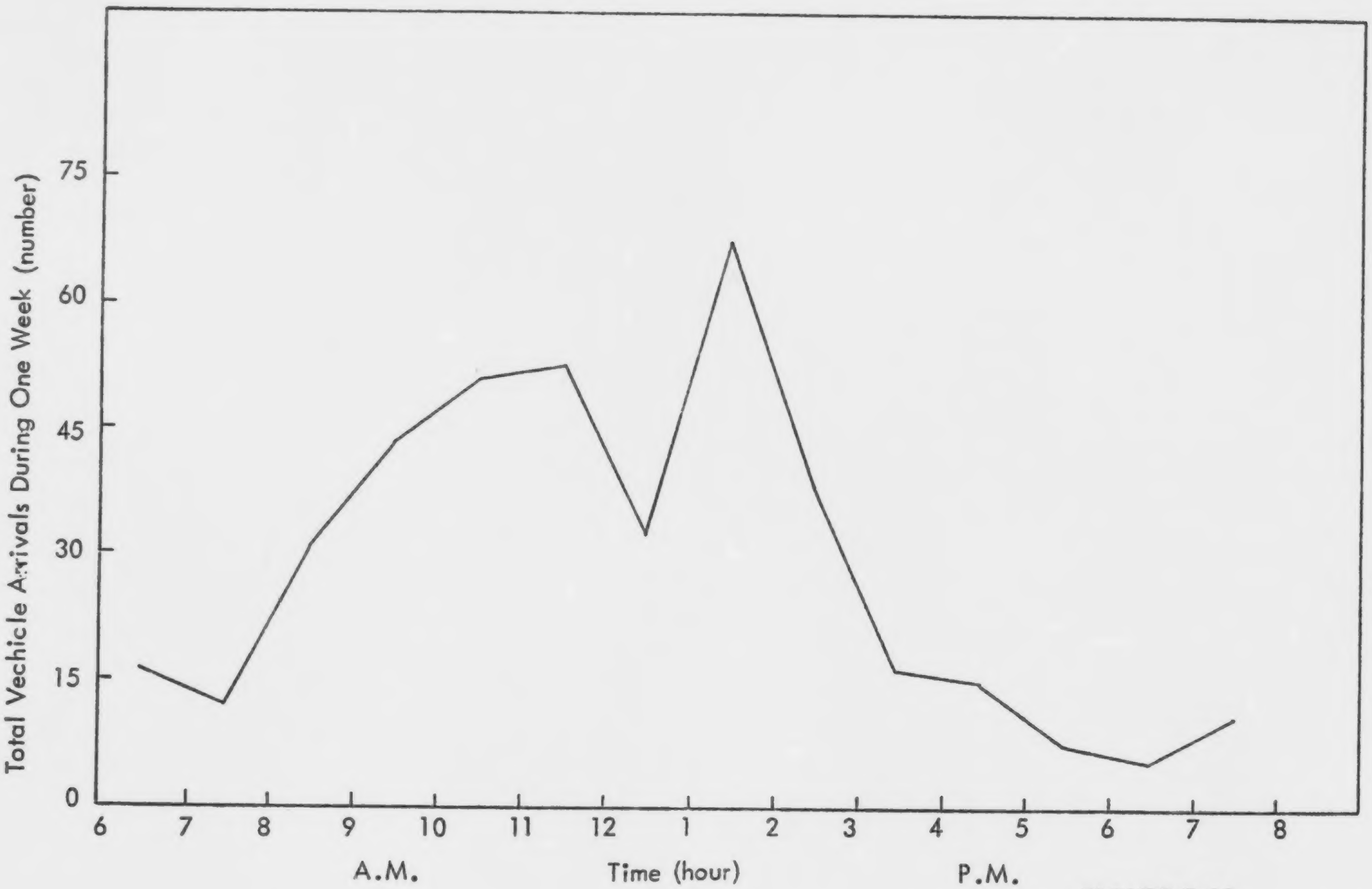


FIGURE E-13
WEEKLY DISTRIBUTION OF VEHICLE ARRIVALS

NOTE: For week of 9/20/73 - 9/26/73.

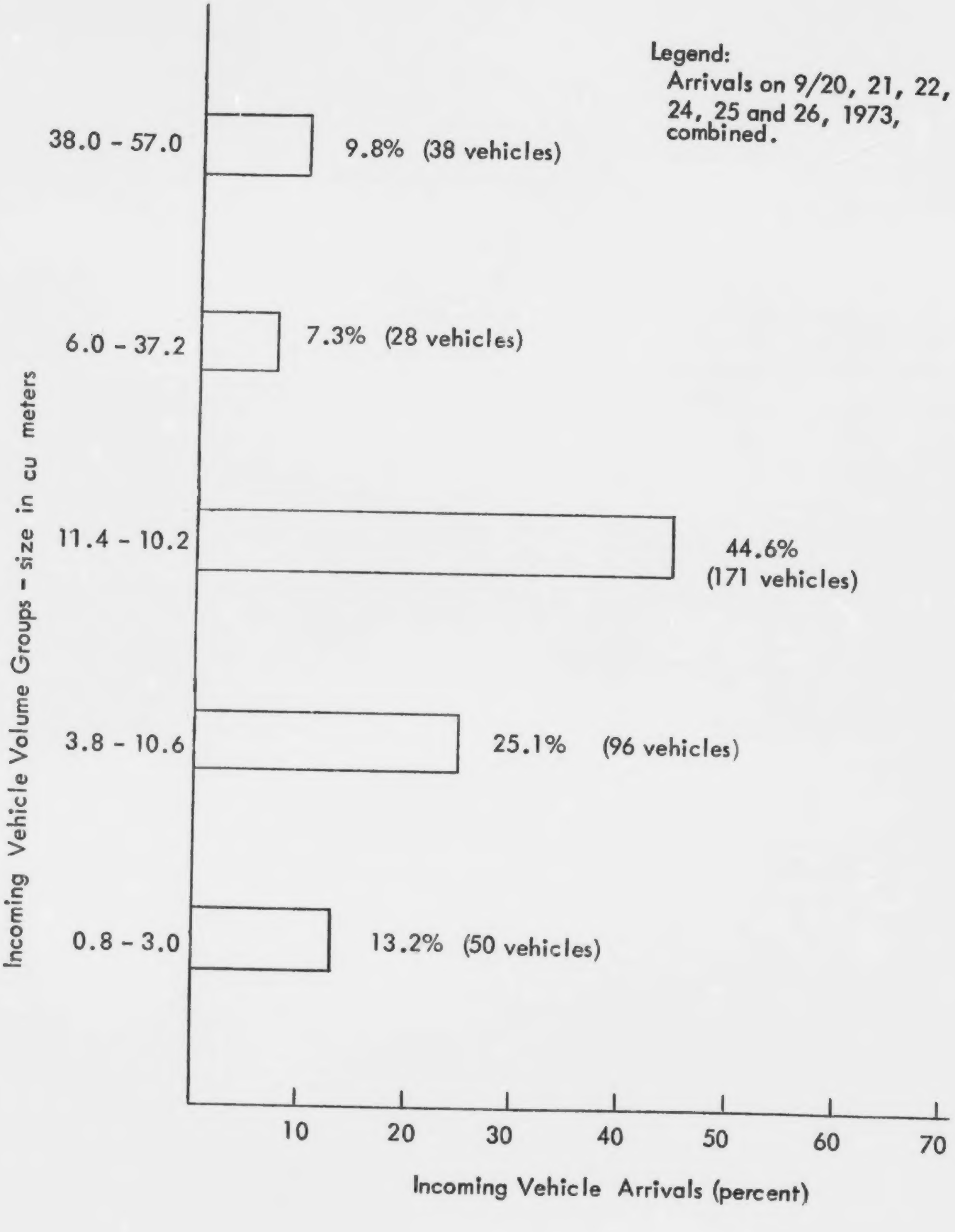


FIGURE E-14
DISTRIBUTION OF VEHICLE ARRIVALS BY VEHICLE SIZE

b. Skills. The necessary physical skills required for the gateman are good vision and hearing, and endurance to stand all day. About 20/30 vision (corrected or uncorrected) is needed to see the location of vehicles, license numbers, items of solid waste, and the print on tickets and schedules. Hearing plays an important role in fulfilling the gateman's responsibilities: he can monitor vehicle location, speed, and direction while filling out forms. Although strength is not necessary for a gateman, he must be able to ambulate and stand all day. During the monitoring the gateman was sometimes overloaded with incoming trucks, but he was idle 55 percent of the day.

Mental skills are: 1) ability to read and write at a high school level, 2) ability to visualize in two dimensions using visual and auditory inputs, 3) ability to understand the operation of incoming trucks and the loader tractor, and 4) ability to understand and manage the size, shape, and location of the solid waste on the floor. Actually, the gateman must understand the basic operations of the loader and trucks; he manages the dumping of the solid waste and so affects the efficiency of the incoming dump trucks and loader tractor. The gateman faced no crucial task skills in that much of his task behavior was writing. Directing dumps, charging fees, and monitoring operations were not time-intensive tasks.

c. Human Factors. The gateman used little equipment: pen, clipboard, tickets, file drawer, and cash register.

The most time-intensive activity was walking. Thus, floor layout was the primary factor in his productivity. The location of his work area is shown in Figure E-11.

The structure of the booth was a second factor of his performance. The booth was heated, with a counter near elbow height and with all forms and equipment located together in front of the gateman. Large windows allowed unobstructed vision of the working floor, but no window provided direct vision outside. Thus, he could always see trucks waiting outside. The forms he used are a third factor, especially in processing trucks; in order to handle all the trucks that arrive at once, he had to process them quickly. Basically, booth location, booth heating, inside and outdoor visibility from the booth, booth counter, drawer and cash register arrangement, and the forms were primary factors affecting the gateman.

2. Loader Operator. The description of the leader operator does not include maintenance and other relatively unstructured activities.

a. Tasks. A loader operator worked each shift. His position was defined as responsibility for keeping the conveyor full, keeping the front floor clear of solid waste so that incoming trucks could maneuver, mixing the solid waste so it baled properly, and removing rejects and recyclables. Activity Chart 1-A and videotapes were used to record and measure time data.

Table E-9 lists production and safety tasks. Since the operator and his machine were integral, the defined tasks for this position were listed as machine operations. The sequences of subtasks were fixed by material handling constraints, but many factors

TABLE E-9
LOADER OPERATOR TASKS

Production Tasks:	Time (min.)	
	Mean	Std. Dev.
A. Load conveyor	0.55	0.15
1. Load bucket	0.10	0.05
2. Carry	0.20	0.10
3. Unload bucket	0.05	0.05
4. Return	0.20	0.10
B. Mix solid waste	0.50	0.20
1. Mix	0.30	0.15
2. Travel	0.20	0.10
C. Clear floor	0.40	0.50
1. Clear floor	0.20	0.50
2. Travel	0.20	0.10
D. Reject /recycle items	-	b
1. Separate from solid waste		
2. Pull out of pile with bucket		
3. Push to side of floor		
4. Travel		
E. Direct dump[a]	-	b
1. Point to correct door		
2. Point to stopping point		
Safety Tasks:		
F. Monitor front floor	Continuously	
1. Watch gateman	-	b
2. Watch trucks	-	b
3. Watch front doors	-	b

[a] Occasional task when gateman is busy.

[b] Unobserved or highly random times.

affected standard times. The "load," "mix," and "clean floor," tasks have been previously defined. The "reject/recycle items" task is an occasional task performed when appropriate items are found by the loader operator. The safety tasks were constantly performed as neck and eye motions to detect obstacles and thus avoid collision. Occasionally, when many trucks arrived simultaneously, the loader operator directed these trucks from his cab.

b. Skills. Necessary physical skills are stringent: good vision (corrected or uncorrected) and hearing, body strength, endurance, good body coordination, and flexibility in neck and back. Basically this operator must have the physical strength, endurance, and coordination to operate an articulated loader on a relatively simple ground layout. The actual skill involved is the ability to watch the entire front floor area while working. The avoidance of collision with other trucks depends heavily on this operator. The loader operator constantly turned his head and twisted at the waist to view rear areas. Hearing is very important in locating other trucks and recognizing verbal warnings.

Necessary mental skills are 1) understanding of the dumping operation, 2) understanding of the need and reasons for mixing solid waste and rejecting and recycling items, 3) ability to manage the piles of solid waste so that trucks can move in and out, and 4) the ability to load the conveyor to the correct height. The loader operator worked the waste piles so that the incoming trucks could move in and out quickly. He mixed the waste sufficiently so that the bales were stable. He was responsible for identifying rejects and recyclables. The loader operator, in loading the conveyor, greatly affected the time for scale loading. He stacked the conveyor o the proper height, and positioned large items correctly, avoiding both long load times and heavy weights falling hard on the scale.

Task skills were typical operating skills of a loader operator under dirt loading and grading operations. He operated at the design efficiency of the loader while observing the floor, waste pile, conveyor, gateman, and other trucks. It is important that he was able to operate at standard time rates with his mind free to observe the surrounding environment. Usually a well-experienced operator was needed to perform under these constraints.

c. Human Factors. The human factors of the loader operator deal with: the loader instruments and controls; the overall layout of the solid waste pile, conveyor, gateman and trucks; and the method of working the face of the pile.

The loader itself was a single unit. The choice of loader was based on other than human factors, such as capacity and cost. Thus, the only loader factors mentioned here are operator visibility over 360° and a heated cab. The manufacturer has presumably optimized instrument and control factors in the loader.

The physical layout of the front area and the method of working the waste pile were two important factors in performance of both incoming trucks and the loader. Basically, time idle, fatigue, and collision-possibility were affected. For example, working one side of the conveyor at a time, while trucks dump on the other side, avoided the need for the operator to wait on these trucks. A procedure keeping obstacles from behind the loader eliminated many twisting motions of the operator. Basically, layout affected possible travel routes, patterns of head motion, methods of mixing and loading at the face of the pile, and waiting on incoming trucks. And the method of working the waste pile determined the effects, such as fatigue, on the operator.

The past pattern of loading is presented in Figure E-15.

3. Control Tower Operator. Tasks, subtasks, skills, and human factors for the control tower operator are described. Only tasks relating to work in production, information, and safety systems are defined.

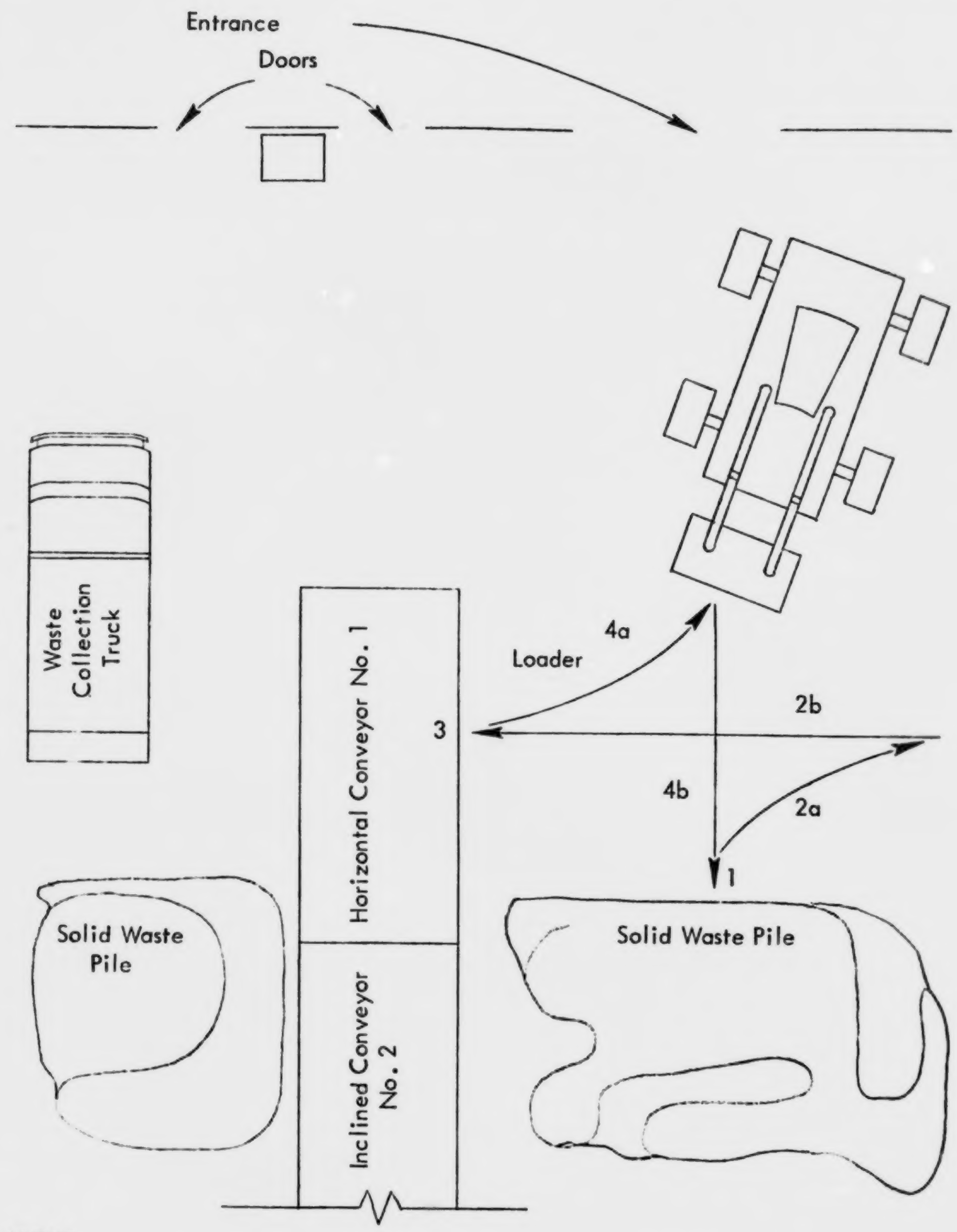
a. Tasks. A control tower operator worked each shift. Tasks are listed in Table E-10, and involve supervising production on the shift, cycling the baler, measuring the charge, getting the transports switched on time, and keeping the convevor full. The control tower operator worked under three sets of conditions - automatic, semiautomatic, and manual sequence control of the conveyor-scale-baler-pusher.

Figures D-2 through D-5 illustrate the control panel. Under automatic operation, the operator merely watched and listened to the machines, and stopped the conveyor when a full charge was on the scale. Under typical semiautomatic operation, the operator used the stop-start buttons for the conveyor, the dump toggle for the scale, and the push No. 1 and No. 2 buttons for the pusher. Under manual operation the operator manually switched all operations. He used the bottom row of toggle switches, the conveyor buttons, and the pusher buttons.

Under all conditions, the control tower operator watched the transport and conveyor as he controlled the conveyor-scale-baler-pusher sequence. If the conveyor was empty, he directed someone to start loading the conveyor. If the transport was full, he informed the driver and lift operator by the P. A. system speaker. He recorded data on time, weight of bales, and reasons for shutdowns.

b. Skills. Physical skills center on perception, in that the control operator mainly observed and pushed buttons. Good vision, about 20/20 (corrected or uncorrected) was necessary to observe the machines and floor from the control tower. Hearing was important in monitoring the machines; an experienced operator received much auditory information.

The mental skills of this operator were the tightest constraint. He has to understand the limits and abilities of the machines in the baling sequence, be able to decide waste charge sizes and bale dimensions, locate jams in the conveyor, pressure losses, jammed bales, and general equipment problems; and to coordinate the central operations of the plant, including directing the activities of other employees.



NOTE:
All inside building.

FIGURE E-15
LOADER MOVEMENT FOR
PLACING WASTE ON CONVEYOR

TABLE E-10
CONTROL TOWER OPERATOR TASKS

Production Tasks:	Standard Times (min.) (Machine Times)
A. Cycle baler	3.05
1. Open lid	0.15
2. Dump platen	0.20
3. Return platen	0.15
4. Close lid	0.15
5. Gatherer forward/differential	0.30
6. Tramper forward/differential	0.35
7. Compactor forward/differential	0.50
8. Bale door open	0.10
9. Compacter forward/differential	0.35
10. Return all rams and close bale door	0.35
B. Load scale	
1. Start conveyor	-
2. Monitor weight and volume of waste	1.50
3. Stop conveyor	-
C. Load transport	
1. Push No. 1 for a bale	0.40
2. Push No. 1 for a second bale	0.90
3. Push No. 2 for both bales	0.90
Information Tasks:	
D. Switch transports	-
1. Monitor number of bales on transport	
2. Call driver and lift operator on P. A.	
E. Keep conveyor full	-
1. Monitor conveyor load	
2. Call for action on P. A.	
F. Record production	-
1. Write bale numbers	
2. Write reasons for downtime	
Safety Tasks:	Continuously
1. Watch floor	
2. Watch machines	

The task skills of the control operator deal with the control panel, scale dial, scale, platen, and conveyor. The operator must be able to locate controls without looking; once located, the controls are easy to activate. He must instantly read the scale dial by the needle angle. He must estimate the volume of waste on the scale and conveyor, and the impact force of waste falling onto the scale. He must constantly observe the transport being loaded and floor areas. His degree of involvement varied under the possible modes, automatic to manual, of operation.

c. Human Factors. The human factors revolved around instrument and control location and design, and the operator's perspective and visibility from the tower. The control panel contains all of the instruments and controls except the scale meter. The panel layout was critical in that the operator had to keep his eyes on the plant operations while using the controls. Basically, all necessary controls were within reach at the bottom of the panel, spaced far enough apart to avoid interference during actuation. Modifications of the controls were undertaken in stages. Thus, the panel had been extended on the left and right sides. The pusher controls were at the far left, while the conveyor controls were at the far right. The new operating scale meter was on the left wall. (See Figure E-16 for the layout.) Operator speed and fatigue were influenced by meter and control location. The control tower floor was five meters (17 feet) above the plant floor. The tower enclosure was glass from the waist to the ceiling. The tower was higher than the conveyor, platen, and charging box, allowing direct observation into these critical areas.

4. Truck Drivers. Tasks, subtasks, skills, and human factors for the truck drivers are described. Only tasks relating to production, information, and safety are defined.

a. Tasks. Two truck drivers worked each shift. They were responsible for driving transport trucks to and from the balefill, rigging and de-rigging the trucks, positioning trucks at the pusher platform, gassing and light maintenance on the trucks. Table E-11 lists the tasks. Each driver was rigidly constrained to the basic sequence of switch trucks at plant, transport, switch trucks at balefill, and return, with occasional stops to gas up and morning chek-outs of equipment on the trucks. Unscheduled repairs were handled by the driver if minor; otherwise, the driver phoned the plant for instructions. (Major repairs were scheduled by a maintenance contract with a private company.)

b. Skills. Physical skills were related to driving a transport. Vision, hearing, strength, and endurance are basic physical qualities. The truck drivers needed to pass the usual medical tests of physical ability. Mental skills also revolved around driving. Reading, mechanical understanding, understanding of the loading and unloading operations, and understanding of the operation of the transports were basic. Task skills were driving the transports, backing down a 33 meter (100-foot) straight path to the baler ejection platform, and rigging and de-rigging the curtain.

c. Human Factors. The human factors of this position revolved around the transports. The truck was designed for driving, and so had factors presumably optimized for productive use. The curtain and tailgate were specially designed for the St. Paul bale-haul conditions. The design of the curtains and tailgate required two men to draw and retract

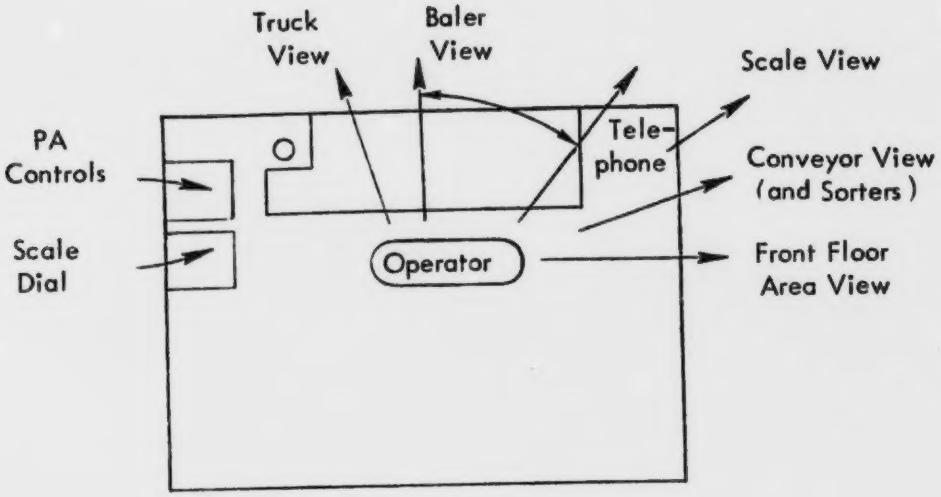


FIGURE E-16
CONTROL TOWER LAYOUT

TABLE E-11
TRUCK DRIVER TASKS

	Time	(min.)
Production Tasks:	Mean	Std.Dev.
A. Switch trucks at plant	-	b
1. Position at ramp (truck 1)	-	
2. Rig using two men (truck 2)	3.5	1.3
3. Pull out (truck 2)	-	b
4. Back in (truck 1)	-	
5. Lock tailgate (truck 2)	1.0	0.3
B. Transport	36	22
1. Drive (truck 2)	29	5
2. Gas (8 percent)[a]	26	21
3. Repair (12 percent)[a]	41	32
C. Switch trucks at bale fill	-	b
1. Pull in (truck 2)		
2. De-rig using two men		
D. Return	35	24
1. Drive (truck 3)	28	7
2. Gas (8 percent)	26	21
3. Repair (12 percent)	41	32
Information Tasks:		
E. Driver's log	-	b
1. Record times of arrival and departure		
Safety Tasks:		
F. Check truck	-	b
1. Tires		
2. Oil		
3. Accessories		
4. Brakes		

[a] Special subtasks performed as needed.

[b] Unobserved times.

the curtain while the drive handles the tailgate alone. In practice the rigging was done once before the transport left the plant; the de-rigging was done once after the transport arrived at the balefill. Rigging times measured during the survey period are shown in Table E-12. The average time to rig was 3.5 minutes, and the average time to lock the tailgate is 0.95 minutes.

Figure E-17 shows the layout of the loading dock and balefill. In both cases, the truck being processed was in position two or three as the next transport arrived at position one. At the loading dock, rigging was done at position two before moving, while the tailgate was put on at three. At the balefill, de-rigging was done at position two; notice that the balefill loader operator swept the bed of the empty transport at position two or three.

5. Resource Recovery. Tasks, subtasks, skills and human factors related to segregation of corrugated paper are described in this section. It should be noted that segregation was not necessary to baling solid waste and could have been discontinued if salvage corrugated paper prices declined significantly.

a. Tasks. Segregation by sorters for recycling was organized to use two men on each shift. As used, the sorters recycled only corrugated paper. Other items were to have been considered for sorting in the future. The only task of the sorters was to segregate the corrugated paper (see Table E-13). They worked either at the top of the conveyor, one on each side, or on the floor piles. From the conveyor sides they reached over to pull out large, dry, clean pieces of corrugated paper. They then turned about 12 degrees and dropped the items down a chute to the floor.

b. Skills. Physical skills were medium-acuity vision and hearing, muscular coordination, and endurance to stand for several hours. The sorter stood on a small platform high in the air; thus, he needed to have a good sense of balance. The ability to identify and judge corrugated paper items required little mental activity. The job required no training or skill development.

c. Human Factors. Figure E-18 illustrates the sorter layout. Factors affecting human performance are sorter platform height relative to the conveyor, the distance the sorter needed to reach, the use of mechanical tools such as hook poles, and the location of the place corrugated paper was dropped.

As performed, the sorters used their hands. This required that they reach farther than the length of their arms at the shoulder. Then they needed to bend forward. Then they twisted 120 degrees and placed the corrugated paper in a chute 180 degrees from the conveyor side of their standing position. Sorters could not reach the middle of the conveyor.

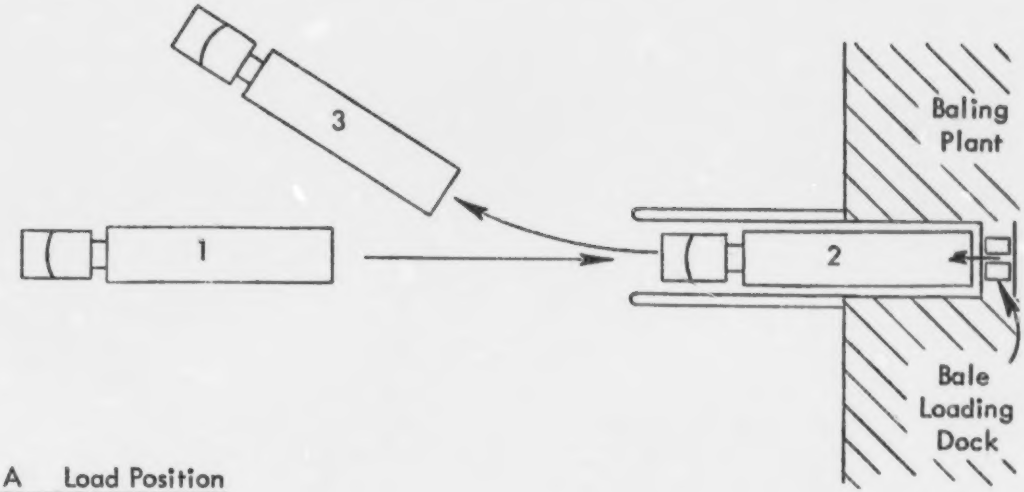
Metal poles 1.9 meters (6 ft) long with hooks were used to reach corrugated paper in the middle of the conveyor. The hook poles also allowed one sorter to remove items from almost the entire width of the conveyor. These poles were not used while the five-day study was conducted.

TABLE E-12

TRANSPORT VEHICLE RIGGING TIME

Date 1973	Time	Rigging Placement Time, (man-minutes)	No. of Men	Tailgate Install. Time (man-minutes)	No. of Men	Bales Loaded per Truck
9/20	9:00 A.M.	7.60	2	-- [a]	--	14
	9:50 A.M.	6.20	2	--	--	16
	10:14 A.M.	6.50	2	1.20	1	14
9/21	7:00 A.M.	10.40	2	1.16	1	14
	7:50 A.M.	7.48	2	0.88	1	14
	8:38 A.M.	8.19	2	--	--	14
	11:05 A.M.	6.40	2	0.86	1	14
	11:45 A.M.	8.98	2	0.53	1	16
	2:50 P.M.	4.80	2	1.35	3	14
9/24	7:15 A.M.	6.72	2	2.76	2	14
	8:35 A.M.	3.82	2	0.89	1	14
	9:20 A.M.	10.66	2	1.10	1	14
	9:58 A.M.	6.40	2		--	14
	10:43 A.M.	8.25	3	1.50	1	14
	12:40 P.M.	6.50	1	0.98	1	16
	1:40 P.M.	4.50	1	--	--	14
9/25	7:55 A.M.	--	--	1.19	1	14
	8:34 A.M.	2.20	2	0.61	1	14
	9:30 A.M.	--	2	1.00	2	14
	10:00 A.M.	--	--	--	--	14
9/26	9:25 A.M.	6.36	2	1.56	2	14
	12:58 P.M.	5.20	2	1.22	1	14
Average		6.69	1.95	1.17	1.29	14.3
Standard Deviation		2.06	0.39	0,51	0.61	0.73

[a] -- Data missing because person taking data was occupied taking tenth bale measurements.



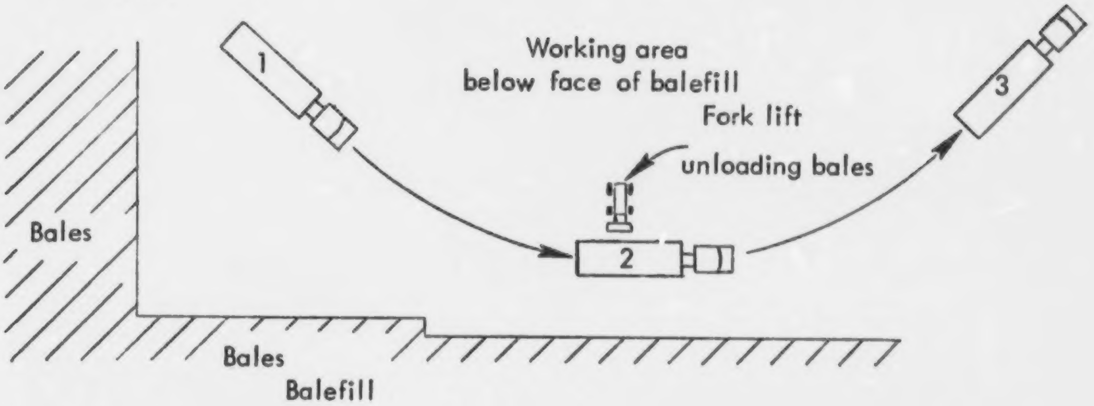
A Load Position

Legend:

1 Approach

2 In position

3 Leave



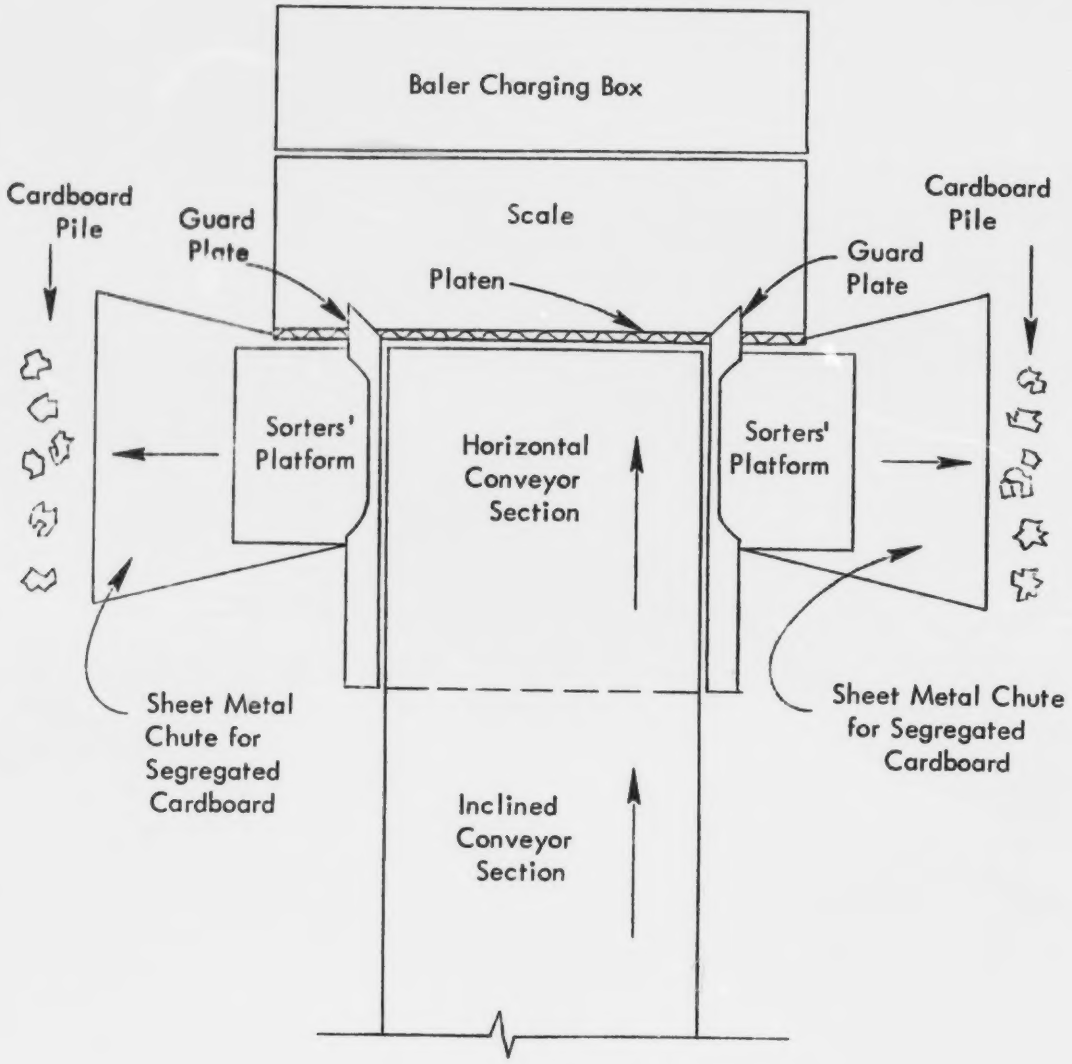
B Unload Position

No Scale

FIGURE E-17
BALE TRANSPORT TRUCK LOAD-UNLOAD POSITION LAYOUTS

TABLE E- 13
SORTER TASKS

Production Tasks:	Time (min.)	
	Mean	Std. Dev.
A. Sort corrugated paper	0.25	0.11
1. Retrieve one or two items	0.20	0.10
2. Drop on a pile	0.05	0.05


Baler Charging Box
Cardboard Pile
Guard Plate
Scale
Cardboard Pile
Guard Plate
Platen
Sorters' Platform
Horizontal Conveyor Section
Sorters' Platform
Sheet Metal Chute for Segregated Cardboard
Sheet Metal Chute for Segregated Cardboard
Inclined Conveyor Section

Top View of Conveyor

Note: Not to scale.

FIGURE E-18
CORRUGATED SORTER
WORK STATIONS

6. Utilization of Positions. Figure E-19 presents the percent utilization of the five position: gateman, loader operator, control tower operator, driver, and sorter. The first three men were observed during plant operations as recorded on Activity Charts 1-A and 1-B. The truck drivers were timed by their logs, video tape, and stopwatch observations. The sorters were video taped for 20 minutes of continuous operation with the conveyor working at the normal rate.

The utilization of the control operator was not totalled. This operator did little physical work, but he continuously watched the machines. Thus, it is very difficult to identify when he was monitoring or idle. In fact, even when all the machines were idle, he was monitoring conditions from his position. Thus his time had been divided to show running utilization of the baler and conveyor. The sorter was watching the conveyor 84 percent of his time. Contrary to the control operator who controlled equipment, the sorter accomplished nothing during the 84 percent watching time. The utilization for the truck driver was obtained from the utilization of the transports. Each driver handled one and a half transports, so that the mean times were increased by 50 percent.

Figure E-19 shows utilization percentages of the average times for each operation. It is important to note that this ignores idle time due to machine breakdowns; if all machines run as designed, the utilization would be as shown. Also, startup and shutdown procedures have been ignored. The time observations were of steady-state operating conditions only. Downtime was analyzed in Section 8.

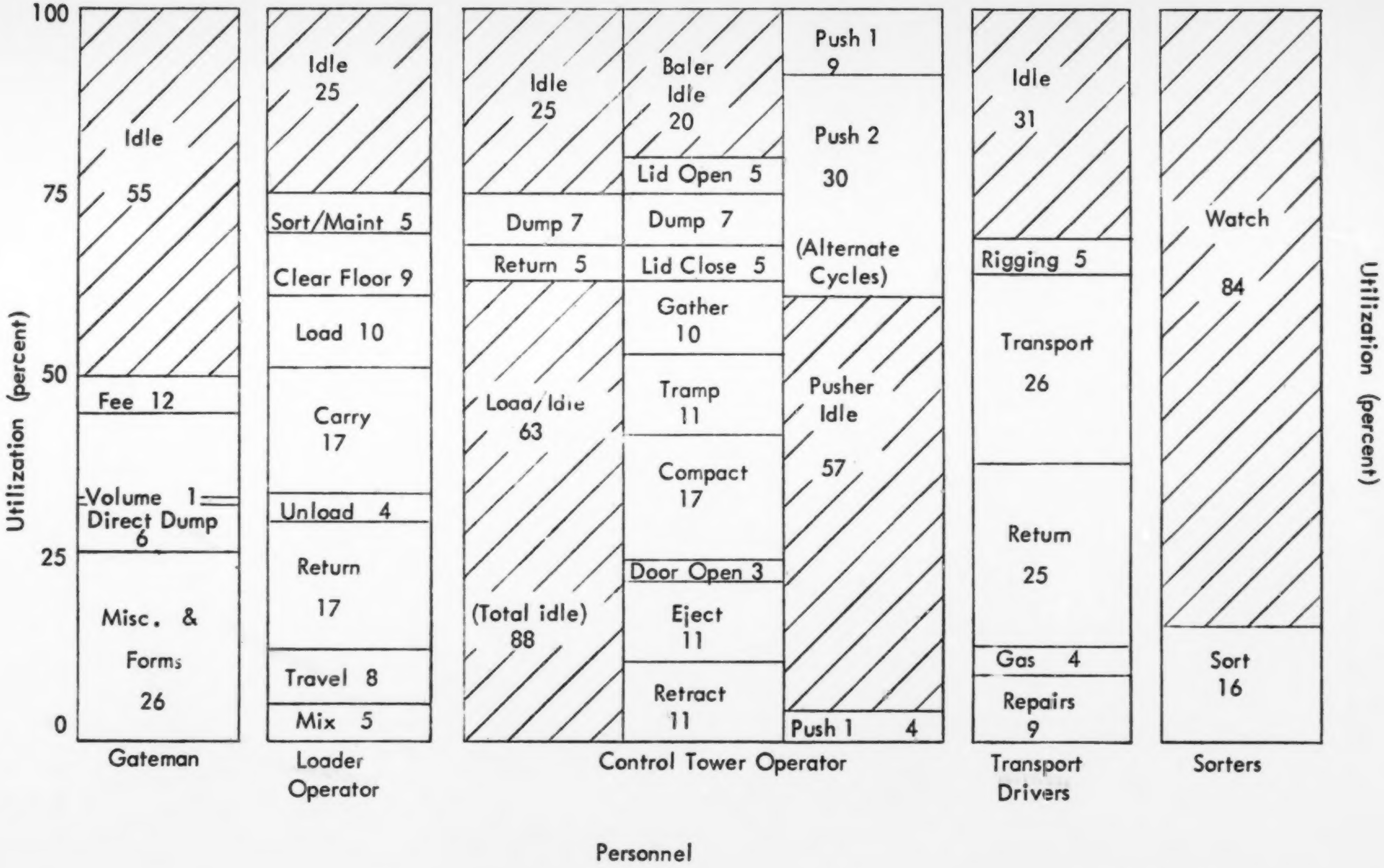


FIGURE E-19
MANPOWER UTILIZATION

APPENDIX F

YEAR-LONG SYSTEM MONITORING DATA FORMS

TABLE F-1
FIELD ACTIVITIES LOG

Observer(s) ____________ Date ________

Hours: start ________ end ________ Checked ________

METEOROLOGICAL:

Ambient Temperature ______ °C

Wind: Speed ________

Direction ________

Humidity ________

Weather:

Precipitation ______ in.

Cloud cover ________

Other and comments: ____________

TEST CELL

Work Tasks

☐ 1. Survey settlement
☐ 2. Gas samples
☐ 3. Temperature
☐ 4. Collect leachate
☐ 5. Lysimeter samples
☐ 6. Rain gage

	Work task no's.	Date	Time	Shipper
Samples mailed:				

Equipment condition ____________

____

Comments ____________

(Continue on back of page)

LANDFILL

Work Tasks

☐ 1. Surface water
☐ 2. Cover soil
☐ 3. Litter
☐ 4. Bale spacing
☐ 5. Time studies
☐ 6. Broken bales
☐ 7. Dust
☐ 8. Odor
☐ 9. Vectors
☐ 10. Fly traps
☐ 11. Data mailed to R. S. & Co.

Truck unload. time ______ min. Bales, no. _____ Bale unload. time ______ min.

Landfill operator(s) ____________ Equip. in use ____________

Activities ____________

Comments on operations ____________

(Continue on back of page)

TABLE F-2
WEEKLY DATA REPORT SUMMARY SHEET
TEMPERATURE

Observer

Page ______ of ______

Date	Ambient	Station 1			Station 2			Station 3		
		S	M-D	B	S	M-D	B	S	M-D	B
Probe No.										

GAS

Date	Station 1		Station 2		Station 3	
	Upper	Lower	Upper	Lower	Upper	Lower

LEACHATE

Date	Vol.	Bottle

BALE SPACING

Bale No.	Space Between Bales (Inches/face)																	
Face	1		2		3		4		5		6		7		8		Avg	
Date	L	W	L	W	L	W	L	W	L	W	L	W	L	W	L	W	L	W

LANDFILL OPERATION RECORD

Date	Time	Surface Water			Rain Gage Level (inches)	Broken Bales (No./100	Cover Soil			
		Puddles (No.)	Avg. Size (sq.ft. x depth)	Area Covered (percent)			No. of Buckets	Cu. yd/ Bucket	Coverage (sq.ft.)	Depth (inches)

LANDFILL ENVIRONMENTAL RECORD

Date	Time	Litter			Dust Column			Vectors		
		Below	Above	Access	Cause	Height (ft.)	Area (%)	Birds (No./sq.ft)	Flies (No./sq.ft)	Other Specify (No.)

TABLE F-3
LANDFILL OPERATION RECORD

Date	Surface Water			Broken Bales	Cover Soil			
	No. Puddles	Avg. Size (Ft^2 x Ft)	Area Covered (%)	(N/100)	No. Buckets	Yd^3/Bucket	Coverage (Ft^2)	Depth (In)
4/22								
4/28								
5/20				1	3	3	200	8
5/27								
6/9								
6/16	2	75 x 1	1	7				
6/26	4	70 x 2.5	15	2				
7/2								
7/8								
7/16								
7/25								
7/30								
8/6	2	750x0.5	10					
8/14	2	600x0.6	4					
8/21								
8/27								
7/3								
9/17								
9/25								
10/14								
10/27				0				5"
10/28								
11/1/73								
11/8								
11/15				3				5-1/2
11/25	16		7	1				

TABLE F-3 (Cont.)
LANDFILL OPERATION RECORD

Date	Surface Water			Broken Bales	Cover Soil			
	No. Puddles	Avg. Size (Ft^2xFt)	Area Covered (%)	(N/100)	No. Buckets	Yd^3/Bucket	Coverage (Ft^2)	Depth (In)
12/1				2				
12/9								
12/15								
12/27				4				
1/4/74				2				
1/13				0				
2/11								
2/17								
2/21	5	20x50	3-5					6"
3/3	3	3500x2.5	65-70					
3/10	7	10x0.12	5					
3/20								
3/23								
3/31	4	10x7	3	1				
4/7								
4/13	1	1600x0.5	15					

TABLE F-4
LANDFILL ENVIRONMENTAL RECORD

Date	Time	Litter			Dust			Odor		Vectors		
		Below	Above	Access	Cause	Height (Ft)	Area (%)	Strength	Type	Birds	Flies	Other
11/1												
11/8	0800	68/100	10/100	20/100				med.	garbage			
11/15	1100	67/100	21/100					"	"			
11/25	1400							mod.	"			
12/1		9/100	9/100					light	"			
12/9	1000							slight	"			
12/15	1400	2/100	4/100					mod.	"			
12/27		48/100						med.	"			
1/4		69/100						med.	"			
1/13		14/100						slight	"			
2/7		81/100						"	"	100		
2/17		10/100	32/100					"	"			
2/24	1030	17/100	34/100					"	"			
3/3	1600	70/100						med.	"			
3/10		68/100						med.	"			
3/20	1000	24/100						mod.		5		
3/23	1320	47/100	23/100	16/100				mod.	"	3		
3/31								med.	"			
4/10	1200	35/100	27/100	27/100				mod.	"	30		
4/13												
4/22		301/100										
4/28		126/100										
5/21	1500	465/100	100/100	3/100	car	7				24		
5/27			48/100	2/100						6		
6/9		31/100	27/100					strong	"	5		
6/16								"	"			

TABLE F-4 (Cont'd)
LANDFILL ENVIRONMENTAL RECORD

Date	Time	Litter			Dust			Odor		Vectors		
		Below	Above	Access	Cause	Height (Ft.)	Area (%)	Strength	Type	Birds	Flies	Other
6/26		91/100	5/100		truck	4	5	strong	garbage	10	3	
7/2					truck	12		light	"			
7/8		200/100	10/100	2/100	"	10		light	"			
7/16												
7/25		4/100		1/100	"	6				4		
7/30		6/100	3/100		car	8'						
8/4					car	6						
8/6						6						

TABLE F-5

TOTAL COST SUMMARY FOR PLANT

By________ Checked________

Period
From________ To__________

Page______ Of____________

No. of Days____________

Item	For This Period	Year To Date
Tons of Waste Received		
Number of Bales Produced		
Total Operating Cost		
Total Depreciation/Interest on Investment		
Total Cost		
Operating Cost Per Ton		
Financing Cost Per Ton		
Total Cost Per Ton		

Comments:

TABLE F-6
TOTAL COST SUMMARY FOR TRANSPORTATION

Period
From__________To__________

No. of Days______________

Page__________Of______________

By__________Checked__________

Item	For This Period	Year To Date
Tons of Waste Hauled		
No. of Bales Hauled		
Total Operating Cost		
Depreciation and Interest on Capital Investment		
Total Cost		
Operating Cost Per Ton		
Financing Cost Per Ton		
Total Cost Per Ton		
Total Cost Per Ton Per Day		

TABLE F-7
TOTAL COST SUMMARY FOR LANDFILL

Period
From__________To__________

Page________Of__________

No. of Days__________

By__________Checked_______

Item	For This Period	Year To Date
Tons of Waste Received		
No. of Bales Received		
Total Operating Cost		
Depreciation and Interest on Capital		
Total Cost		
Operating Cost Per Ton		
Financing Cost Per Ton		
Total Cost Per Ton		
Total Cost Per Ton Per Day		

TABLE F-8

PERIOD BALE PLANT STATIONARY EQUIPMENT COST

Period Covered: By__________ Checked__________

From__________ To__________ Page__________ of__________

Equipment Identification		Baler	Baler Aux. Equipment	Conveyor 1	Conveyor 2	Plant	Sub Total
Week 1	Maint.						
	Repair						
	Operation						
	Total						
Week 2	Maint.						
	Repair						
	Operation						
	Total						
Week 3	Maint.						
	Repair						
	Operation						
	Total						
Week 4	Maint.						
	Repair						
	Operation						
	Total						
TOTAL.							

Maint. = scheduled Repair = unscheduled breakdowns Operation = utilities, labor for operation

Baler Aux. Equipment = pumps, motor, valves on hydraulic system Plant = building, such as roofing, siding, doors, utilities, etc.

TABLE F-9
PERIOD BALE PLANT MOBILE EQUIPMENT COST

Period Covered:
From ____________ To ____________

By ____________

Page ________ of ________
Checked ____________

Equipment Identification		Loader*	Bobcat+	Forklift°			Sub total
Week 1	Maint. Repair Operation Total						
Week 2	Maint. Repair Operation Total						
Week 3	Maint. Repair Operation Total						
Week 4	Maint. Repair Operation Total						
Total							

* Loader - Cat 930 Diesel
+ Bobcat - International Harvester 3200A
° Forklift - Clarklift CF 40 Type 6 Serial No. CF 40B-149-2052-069

TABLE F-10
PERIOD TRANSPORT EQUIPMENT COST

Period Covered By________________ Checked__________

From__________________ To____________ Page__________ of________________

Vehicle License No.					Weekly Total
Week 1 Lease M+R* Fuel Oil Total					
Week 2 Lease M+R* Fuel Oil Total					
Week 3 Lease M+R* Fuel Oil Total					
Week 4 Lease M+R* Fuel Oil Total					
Week 5 Lease M+R* Fuel Oil Total					
Individual Vehicle Totals					

*M + R = Maintenance and Repair

NOTE: For leased vehicles enter applicable cost of lease and other direct operating costs.

TABLE F-11
PERIOD LANDFILL EQUIPMENT COST

Period Covered: By__________ Checked______

From__________ To__________ Page______ of______

Vehicle License No.	Forklift Loader^{+}	Loader^{++}	Dozer	Trailer, Lights, and Generator	Weekly Total
Week 1 Lease M+R* Fuel Oil Total					
Week 2 Lease M+R* Fuel Oil Total					
Week 3 Lease M+R* Fuel Oil Total					
Week 4 Lease M+R* Fuel Oil Total					
Week 5 Lease M+R* Fuel Oil Total					
Individual Vehicle Totals					

[+] Forklift, articulated, Allis Chalmers Model 840, deisel

[*] Maintenance and Repair

[++] Loader, articulated, Trojan Model 4000

TABLE F-12
PERIOD OPERATIONS SUMMARY

Period Covered By____________ Checked________

From__________ to____________ Page________ of____________

LABOR COST

	Week 1	Week 2	Week 3	Total for Month
Plant				
Transport				
Landfill				
Total				

EQUIPMENT MAINTENANCE

Mobile				
Stationary				
Total				

UTILITIES COST

Gas				
Electric				
Water				
Telephone				
Other_____				
Total				

MISCELLANEOUS COST

Identify				
____________				
____________				
____________				
____________				
Total				

FIXED COST

Plant				
Transport				
Landfill				
Total				
Sub Totals				

TABLE F-13
PERIOD LABOR REPORT

Period Covered:

From ____________ to ____________

By ____________ Checked ____________

Page ____________ of ____________

Shift 1 2	Week 1 Job/Hours	Week 2 Job/Hours	Week 3 Job/Hours	Week 4 Job/Hours	Week 5 Job/Hours	Job Totals	Comments (Include shift hour changes, causes of absences, changes in number of laborers, etc)
PLANT							
							Plant Subtotal
TRANSPORTATION							
							Transport Subtotal
LANDFILL							
							Landfill Subtotal

Abbreviations: LO-Landfill Operations D - Driving to and from site PH - Plant Handling (sorting, charging)
PR - Plant Receiving S - Supervision RM - Repairs and Maintenance (include part-time repair men)

APPENDIX G

LANDFILL OBSERVATIONS AND TEST-CELL MONITORING DATA

TABLE G-1
TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/20/73

	Mean		St. Dev.	
	Meters	Inches	Meters	Inches
10 Minutes				
Max. Height	1.13	44.33	0.052	2.06
Min. Height	1.05	41.23	0.025	1.00
Max. Width	0.99	39.05	0.023	0.91
Min. Width	0.96	37.70	0.018	0.73
Max. Length	1.34	52.63	0.106	4.19
Min. Length	1.27	50.00	0.107	4.22
Ave. Height	1.09	42.78	0.056	2.19
Ave. Width	0.97	38.37	0.024	0.95
Ave. Length	1.30	51.32	0.047	1.86
One Hour				
Max. Height	1.14	44.96	0.058	2.29
Min. Height	1.05	41.36	0.036	1.41
Max. Width	1.02	40.11	0.047	1.86
Min. Width	0.97	38.25	0.025	1.00
Max. Length	1.38	54.39	0.106	4.17
Min. Length	1.28	50.36	0.111	4.36
Ave. Height	1.10	43.16	0.064	2.55
Ave. Width	1.00	39.18	0.033	1.31
Ave. Length	1.33	52.37	0.072	2.85

TABLE G-2
TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/21/73

	Mean		St. Dev.	
	Meters	Inches	Meters	Inches
10 Minutes				
Max. Height	1.20	47.29	0.097	3.81
Min. Height	1.09	43.04	0.068	2.66
Max. Width	1.06	41.64	0.070	2.74
Min. Width	1.00	39.36	0.042	1.67
Max. Length	1.48	58.11	0.152	5.98
Min. Length	1.39	54.68	0.155	6.10
Ave. Height	1.15	45.16	0.076	3.00
Ave. Width	1.03	40.50	0.041	1.62
Ave. Length	1.43	56.39	0.061	2.42
One Hour				
Max. Height	1.17	46.04	0.087	3.42
Min. Height	1.07	42.07	0.052	2.05
Max. Width	1.03	40.46	0.035	1.39
Min. Width	0.98	38.71	0.029	1.15
Max. Length	1.43	56.39	0.142	5.61
Min. Length	1.35	53.14	0.137	5.39
Ave. Height	1.12	44.05	0.071	2.80
Ave. Width	1.01	39.59	0.031	1.24
Ave. Length	1.39	54.77	0.058	2.30

TABLE G-3
TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/24/73

	Mean		St. Dev.	
	Meters	Inches	Meters	Inches
10 Minutes				
Max. Height	1.16	45.71	0.064	2.55
Min. Height	1.06	41.68	0.027	1.08
Max. Width	1.04	41.00	0.033	1.29
Min. Width	0.98	38.68	0.029	1.14
Max. Length	1.38	54.43	0.072	2.83
Min. Length	1.23	48.46	0.083	3.26
Ave. Height	1.11	43.70	0.072	2.85
Ave. Width	1.01	39.84	0.042	1.64
Ave. Length	1.31	51.45	0.107	4.22
One Hour				
Max. Height	1.21	47.57	0.074	2.93
Min. Height	1.08	42.71	0.036	1.41
Max. Width	1.08	42.36	0.055	2.15
Min. Width	0.99	39.14	0.032	1.25
Max. Length	1.44	56.86	0.099	3.88
Min. Length	1.26	49.71	0.085	3.33
Ave. Height	1.15	45.14	0.087	3.43
Ave. Width	1.04	40.75	0.058	2.27
Ave. Length	1.37	53.29	0.128	5.05

TABLE G-4
TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/25/73

	Mean		St. Dev.	
	Meters	Inches	Meters	Inches
10 Minutes				
Max. Height	1.19	46.82	0.052	2.04
Min. Height	1.14	44.86	0.047	1.85
Max. Width	1.09	42.91	0.036	1.41
Min. Width	1.04	40.91	0.040	1.59
Max. Length	1.38	54.50	0.170	6.70
Min. Length	1.31	51.45	0.181	7.12
Ave. Height	1.16	45.81	0.035	1.38
Ave. Width	1.06	41.91	0.036	1.41
Ave. Length	1.35	52.98	0.054	2.15
One Hour				
Max. Height	1.22	48.09	0.078	3.10
Min. Height	1.18	46.32	0.051	2.00
Max. Width	1.13	44.50	0.048	1.90
Min. Width	1.07	42.21	0.046	1.81
Max. Length	1.47	57.77	0.149	5.85
Min. Length	1.40	55.09	0.151	5.96
Ave. Height	1.20	47.20	0.032	1.25
Ave. Width	1.10	43.33	0.041	1.62
Ave. Length	1.36	53.43	0.048	1.90

TABLE G-5
TENTH BALE DIMENSIONS AT 10 MINUTES AND ONE HOUR - 9/26/73

	Mean		St. Dev.	
	Meters	Inches	Meters	Inches
10 Minutes				
Max. Height	1.18	46.61	0.060	2.37
Min. Height	1.05	41.17	0.035	1.39
Max. Width	1.17	46.00	0.108	4.24
Min. Width	1.06	41.67	0.061	2.41
Max. Length	1.44	56.72	0.081	3.17
Min. Length	1.31	51.72	0.093	3.67
Ave. Height	1.11	43.89	0.098	3.85
Ave. Width	1.11	43.83	0.078	3.06
Ave. Length	1.38	54.22	0.136	5.36
One Hour				
Max. Height	1.22	47.89	0.049	1.93
Min. Height	1.06	41.72	0.021	0.83
Max. Width	1.18	46.39	0.068	2.69
Min. Width	1.05	41.33	0.054	2.11
Max. Length	1.51	59.28	0.125	4.92
Min. Length	1.36	53.61	0.140	5.52
Ave. Height	1.14	44.81	0.111	4.36
Ave. Width	1.11	43.86	0.091	3.57
Ave. Length	1.43	56.44	0.102	4.01

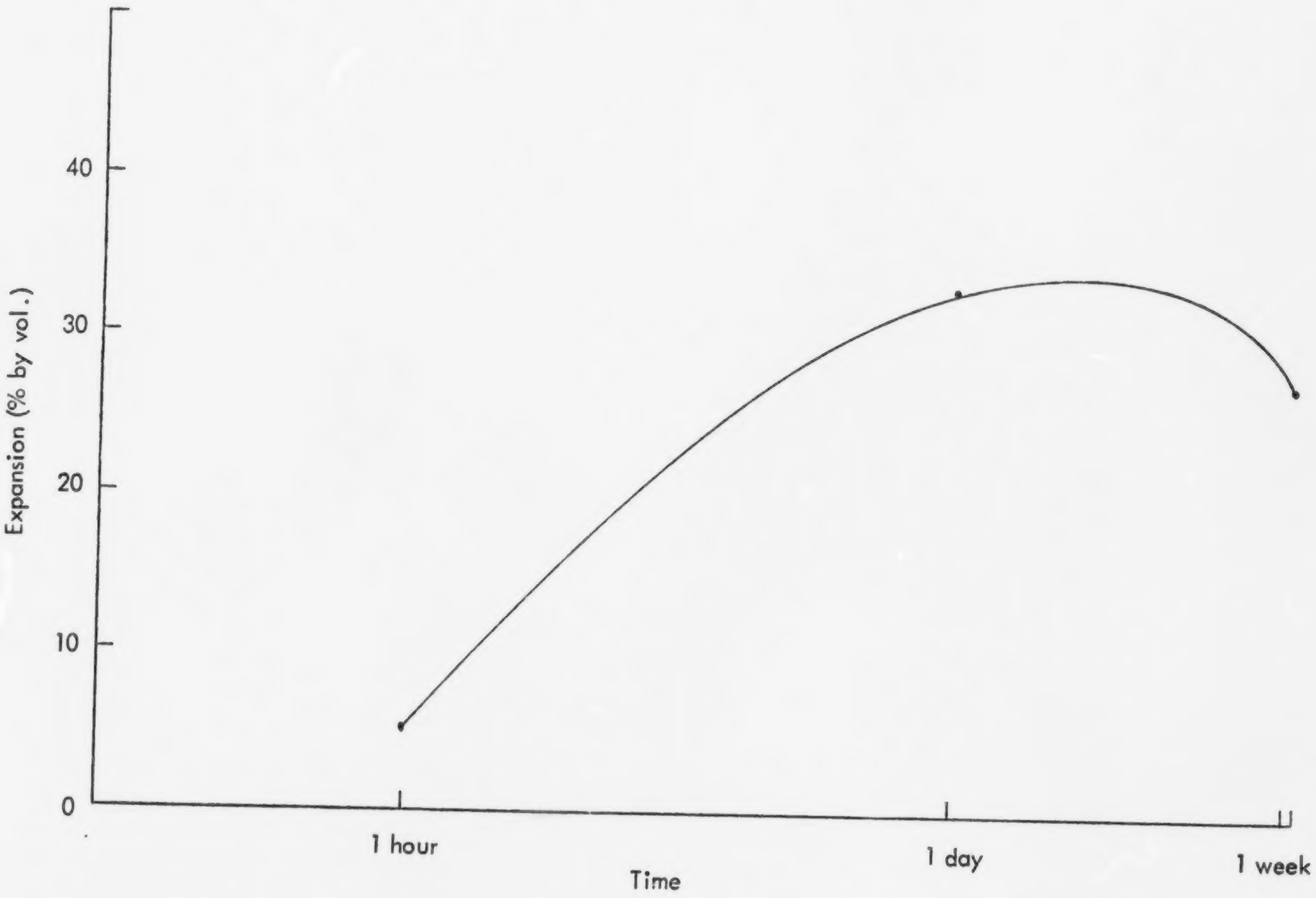


FIGURE G-1

BALE EXPANSION 9/20/73

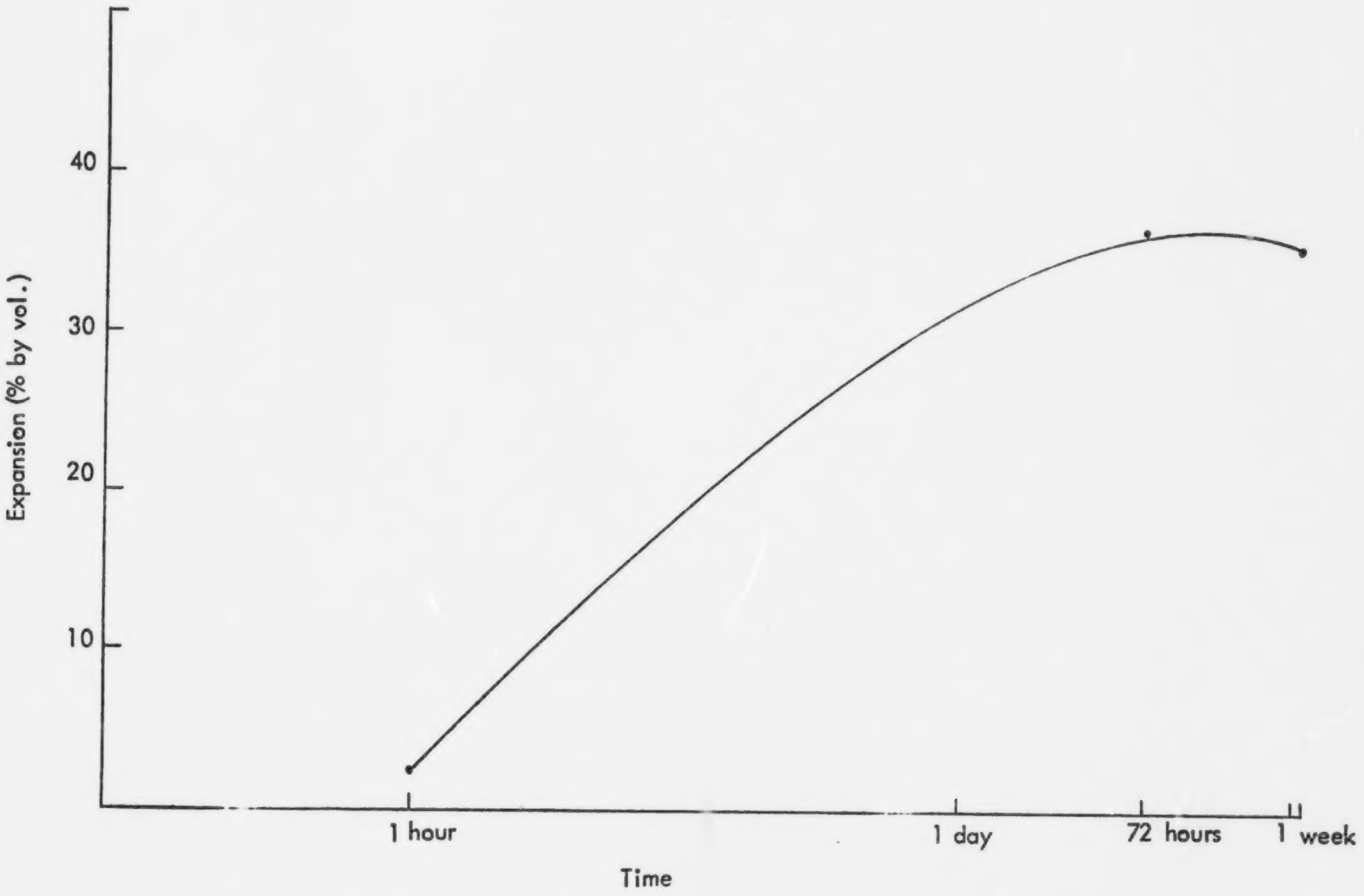


FIGURE G-2
BALE EXPANSION-9/21/73

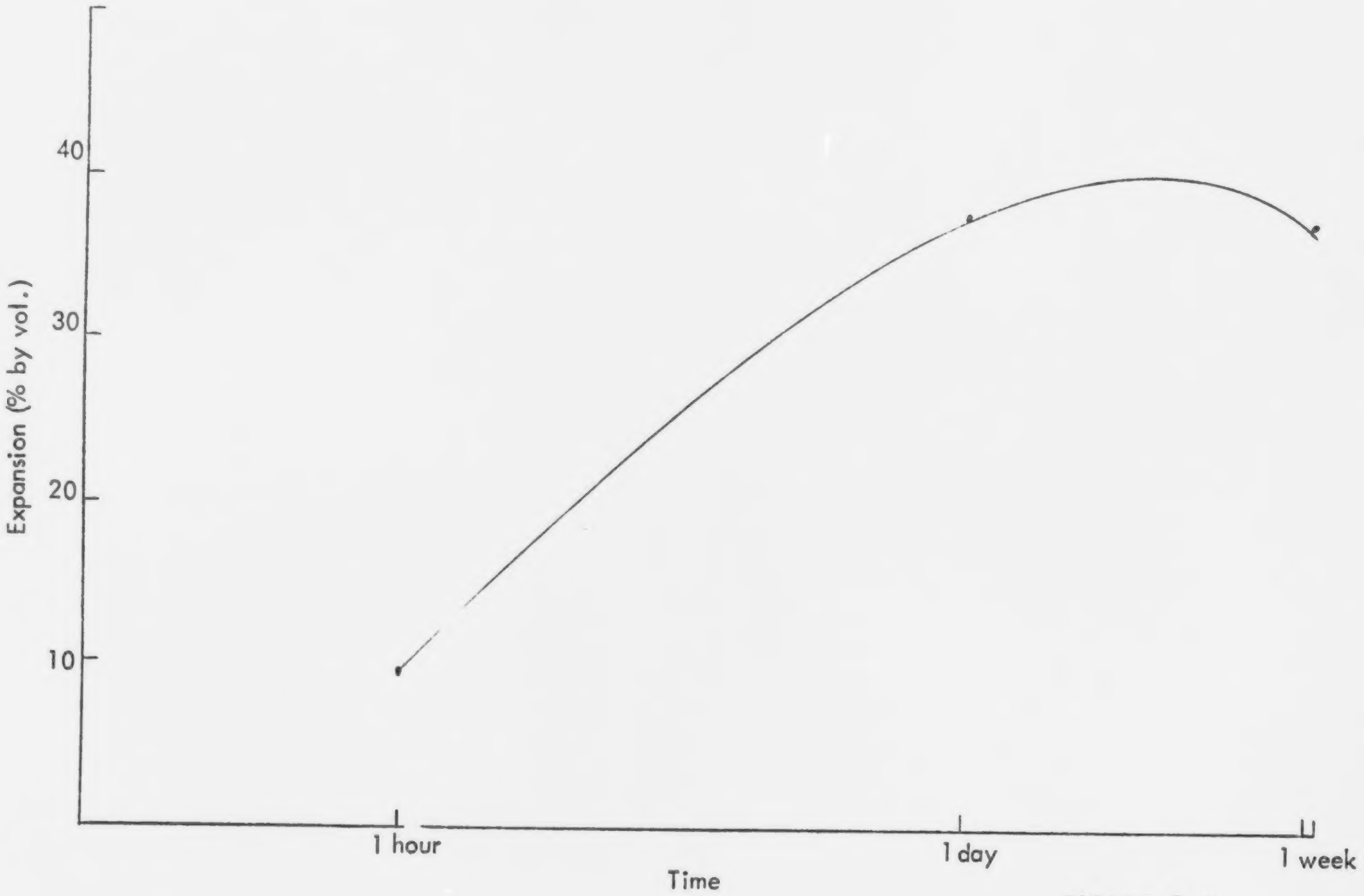


FIGURE G-3
BALE EXPANSION-9/24/73

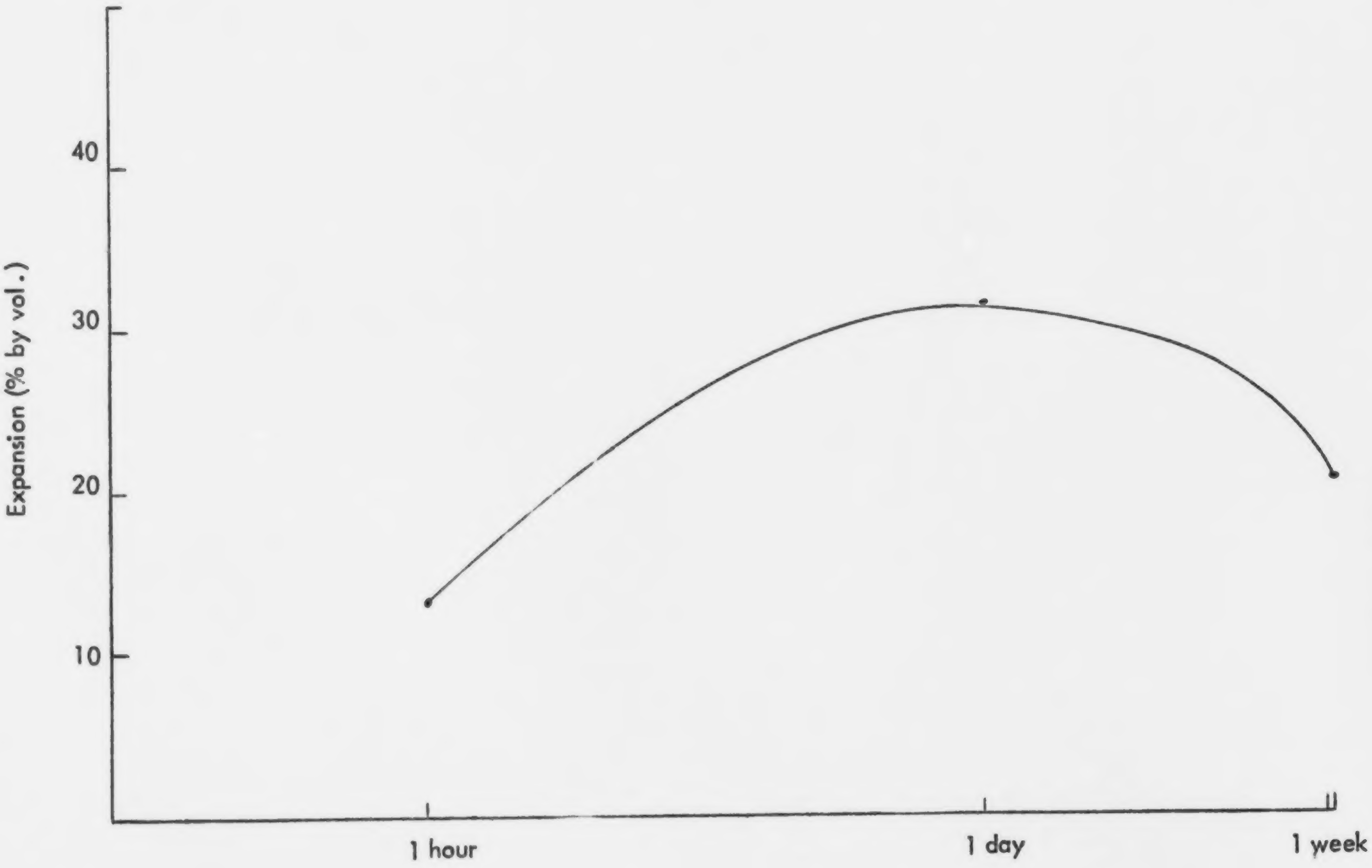


FIGURE G-4
BALE EXPANSION-9/25/73

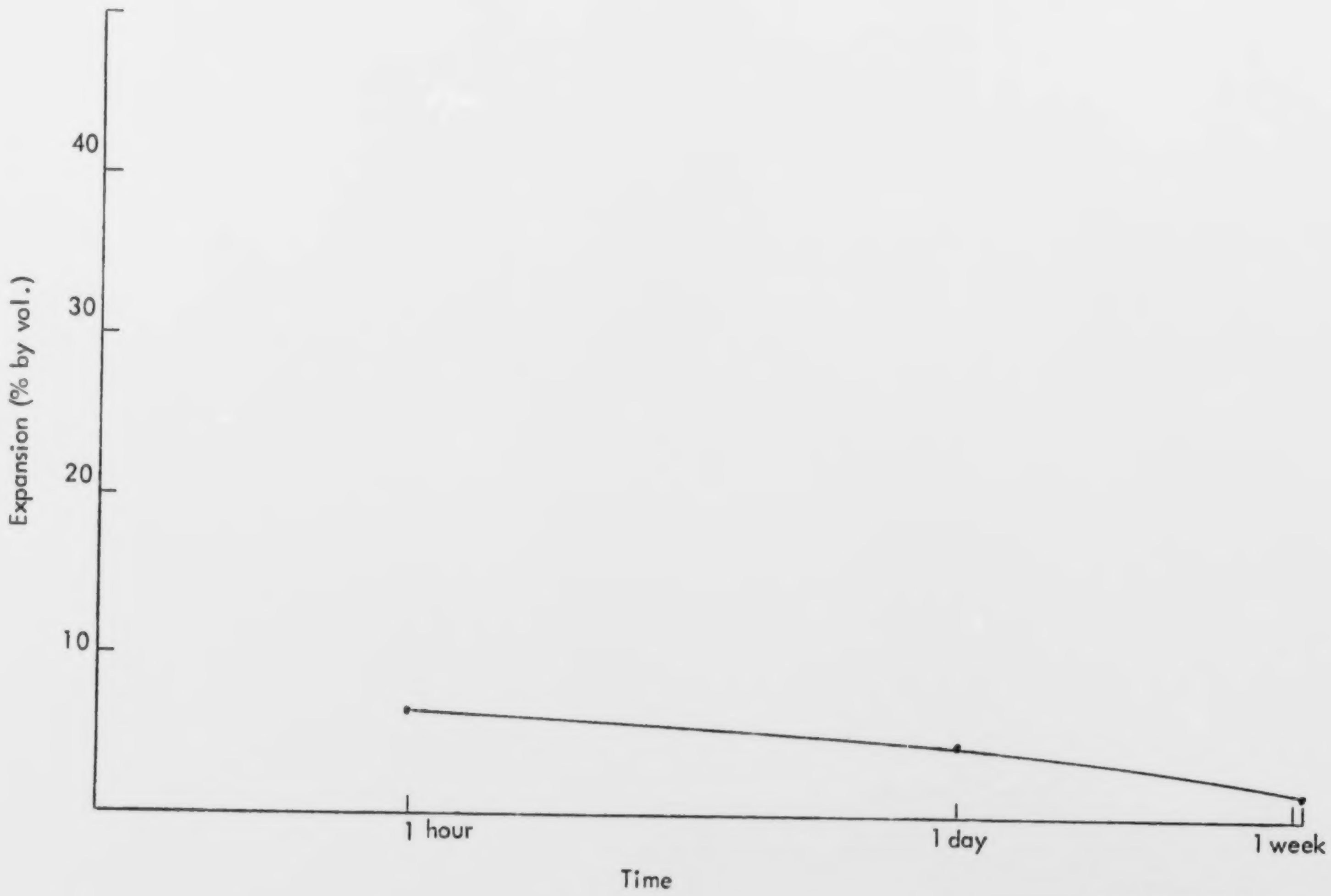


FIGURE G-5
BALE EXPANSION-9/26/73

TABLE G-6
BALE SPACING RESULTS

Date		Spacing Between Bales, cm							
		Maximum		Minimum		Average		Std. Deviation	
		Width	Length	Width	Length	Width	Length	Width	Length
1974									
1/4		10.2	30.5	0	0	4.6	13.4	3.7	8.3
1/13		3.8	99.0	0	1.9	0.6	16.0	1.2	27.9
2/7		2.5	55.9	0	8.9	1.1	24.8	1.0	15.6
2/17		6.4	17.8	0	0	0.6	10.2	1.9	6.2
2/24		8.9	--	0	--	2.2	--	2.7	--
3/10		6.4	20.3	0	2.5	1.0	8.0	2.0	5.4
3/20		6.4	61.0	0	0	1.2	7.7	2.1	17.8
3/24		7.6	63.5	0	3.8	2.5	15.4	2.3	16.9
3/31		6.4	30.5	0	1.3	1.4	9.8	2.2	8.6
4/22		15.2	43.2	0	0	4.8	15.3	4.6	13.8
4/28		6.4	17.8	0	0	0.9	10.0	2.0	6.7
5/21		0	20.3	0	0	0	7.0	0	6.3
	**	15.2	1.3	0	0	4.8	0.1	6.0	0.4
5/29		2.5	20.3	0	0	0.5	7.2	0.8	6.6
	**	5.1	3.8	0	0	1.7	0.4	2.0	1.1
6/19		7.6	3.8	0	0	2.3	0.5	2.9	1.2
6/16		15.2	16.5	0	0	2.4	5.2	4.6	5.3
	**	1.3	17.8	0	0	0.1	6.1	0.4	5.6
6/26		17.78	30.48	0	0	1.9	5.5	5.3	9.8
	**	15.24	5.08	0	0	4.3	0.8	4.5	1.5

** Working Face

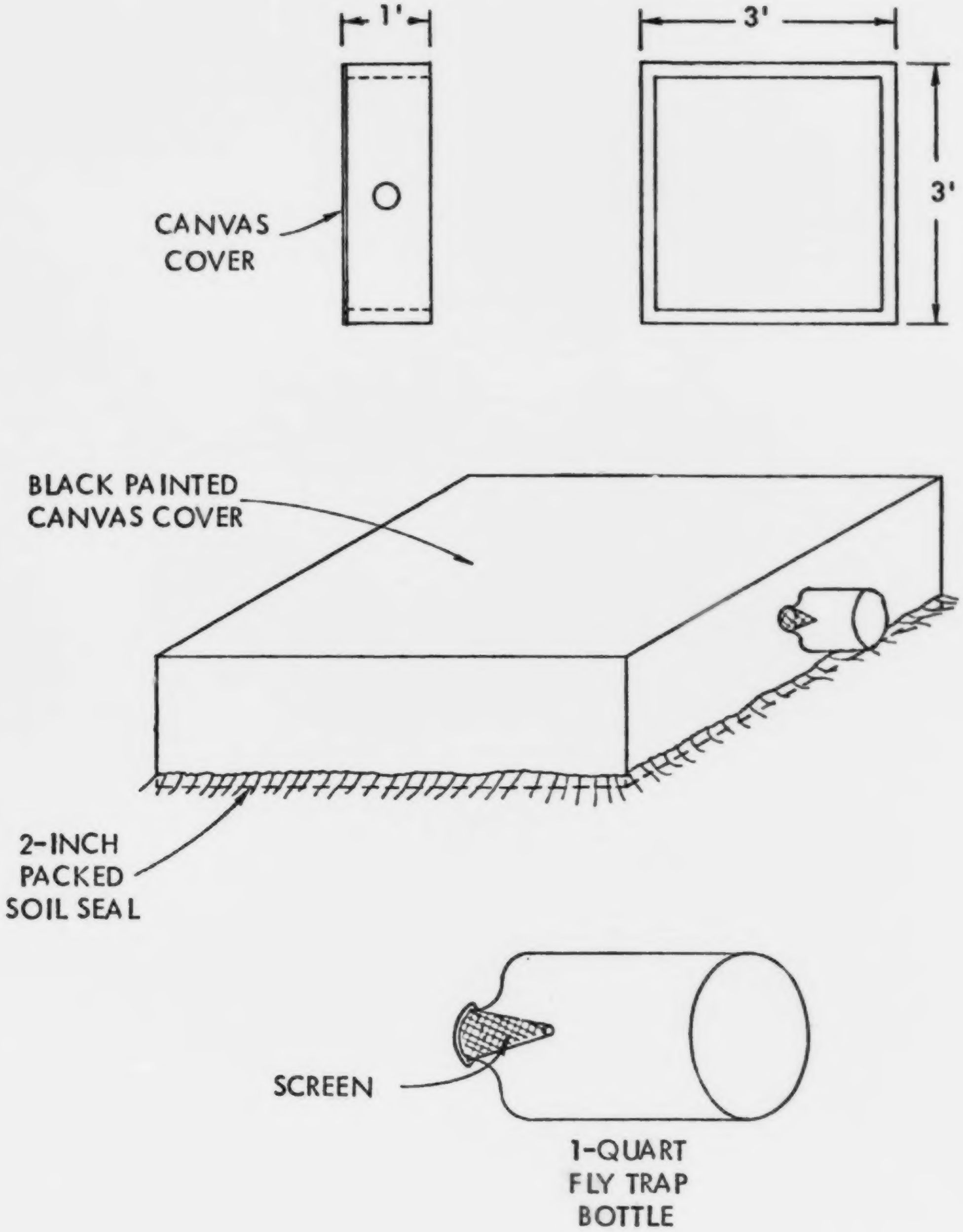
TABLE G-6(Cont.)
BALE SPACING RESULTS

Date	Spacing Between Bales, cm							
	Maximum		Minimum		Average		Std. Deviation	
	Width	Length	Width	Length	Width	Length	Width	Length
1973								
10/10	20.3	--	0	--	6.6	--	7.2	--
10/14	20.3	--	1.3	--	8.4	--	6.2	--
10/16	7.8	--	0	--	3.1	--	5.3	--
10/17	6.4	58.4	0	0	2.2	17.8	2.3	17.5
10/18	5.1	15.2	0	0	1.3	6.0	1.5	5.5
10/20	76.2	38.1	0	0	14.8	7.9	22.3	10.6
10/27	61.0	61.0	0	0	17.8	21.6	17.1	17.9
11/3	1.3	35.6	0	0	0.1	8.4	0.4	9.7
11/10	1.3	25.4	0	1.3	0.1	11.4	0.4	6.3
11/15	2.	25.4	0	0	0.4	10.7	0.9	8.7
12/1	15.2	25.4	0	0	2.8	8.8	5.3	9.1
12/9	3.8	30.5	0	0	0.9	7.5	1.3	9.2
12/15	5.1	21.6	0	0	1.0	9.8	1.8	7.3
12/27	15.2	22.9	0	0	2.7	7.9	4.7	6.8

TABLE G-7
LITTER COUNT RESULTS

	Below Face	Above Face	Access Road
No. Observations	25	15	7
Range ($\frac{\text{no. pieces}}{100\ \text{ft}^2}$)	2 to 425	3 to 207	1 to 82
Average ($\frac{\text{no. pieces}}{100\ \text{ft}^2}$)	81	39	22
No. Observations Excluding Values $\geq$ 100	20	13	6[a]
Range ($\frac{\text{no. pieces}}{100\ \text{ft}^2}$)	2 to 70	3 to 50	1 to 27
Average ($\frac{\text{no. pieces}}{100\ \text{ft}^2}$)	48	21	12

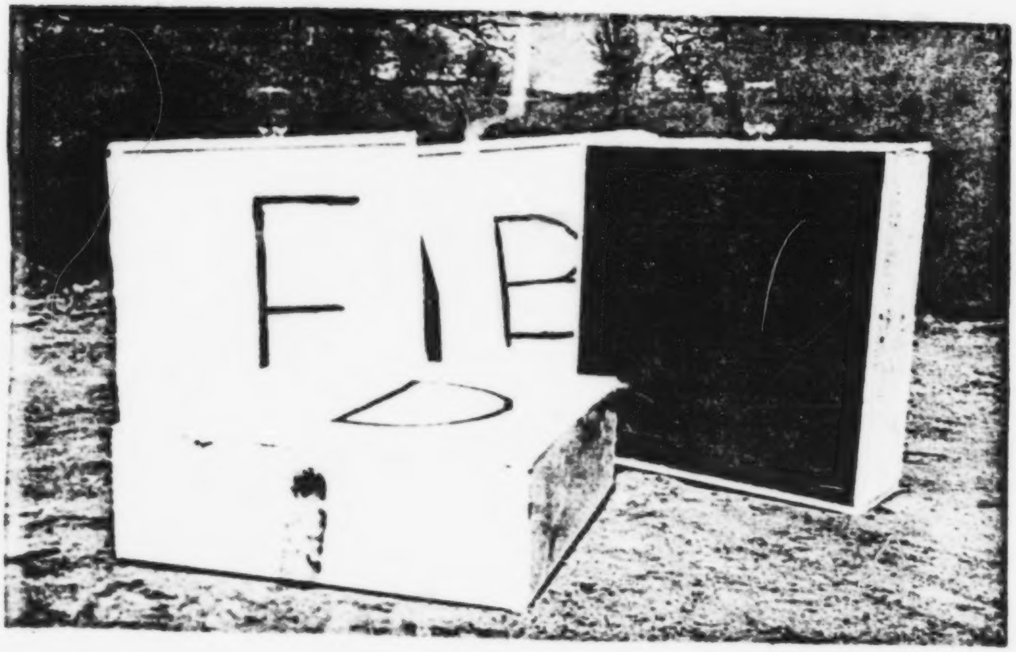
[a] No values > 100; excludes the 82 value, which appeared to be errant considering the range of other values.



Not to Scale

FIGURE G-6
FLY EMERGENCE TRAPS

a. Trap Placement



b. Traps

PHOTOGRAPH G-1
FLY EMERGENCE TRAPS

TABLE G-3
FLYING INSECTS COLLECTED IN THE BALEFILL FLY EMERGENCE TRAPS*

	Traps on Cover Soil	Families	Traps on Bales	Families
MAY	C	Metopiidae (bottle flies)	A	Specimens mangled
	E	Asilidae (robber flies)	B	None collected
	F	None collected		
JUNE	A	Scarabacidae (dung beetles) Silphidae (carrion beetles Metopiidae Drosophilidae (fruit flies)	B	Staphylinidae (scavenger beetles) Mycetophilidae (fungus gnats)
			C	Silphidae Staphylinidae
	E	Silphidae Staphylinidae Asilidae Scatopsidae (scavenger flies) Metopiidae Drosophilidae Culicidae (mosquitos) Mycetophilidae		
	F	Metopiidae Scatopsidae Mycetophilidae		

* Trap D was destroyed by the loader during placement of cover soil.

TABLE G-9
LAND DISPOSAL EVALUATION SHEET

	Points Possible	St. Paul Site
I. EMPLOYEE FACTORS		
1. Facilities		
a. Adequate shelter, hygiene facilities	(3) *	
b. Adequate shelter-minimal hygiene facilities	(2)	2
c. Inadequate shelter, hygiene facilities	(0)	
2. Communications		
a. Radio or telephone on-site	(2)	
b. Telephone or radio within 3-miles	(1)	1
c. No communications	(0)	
3. Accident Prevention and Safety		
a. Periodic training given, equipment provided with safety features, first aid readily available on-site	(2)	2[a]
b. Periodic training given, equipment provided with safety features, first aid available within 3-miles of site	(1)	
c. No training, no first aid available	(0)	
d. Unsafe equipment and/or practices	(-5)	
4. Fire Protection		
a. Adequate water supply, local fire company available on call, open burning prohibited	(3)	3
b. Poor fire protection, open burning prohibited	(2)	
c. No fire protection, open burning allowed	(0)	
5. Parking Facilities and Access Road Conditions		
a. All weather, adequate parking	(3)	3[b]
b. All weather, inadequate parking	(2)	
c. Negotiable only in good weather	(0)	
Sub Total	(13)	11
II. OPERATIONAL FACTORS		
1. Weighing Facilities		
a. Fixed or portable scales available on-site	(2)	2[c]
b. Scale available near site	(1)	
c. No weighing facilities nearby	(0)	
2. Access Limited		
a. Access by unauthorized vehicles and pedestrians prohibited and prevented	(3)	3
b. Access prohibited except during day	(2)	
c. Uncontrolled access to site	(0)	

TABLE G-9 (Cont.)
LAND DISPOSAL EVALUATION SHEET

		Points Possible	St. Paul Site
3.	Solid Waste Unloading Control		
a.	Controlled, area restricted	(2)	2
b.	Controlled, area unrestricted	(1)	
c.	No control	(0)	
4.	Working Area		
a.	Size of working area small, but adequate for peak traffic	(2)	2
b.	Working area larger than necessary to handle traffic	(1)	
c.	Much larger working area than necessary and/or uncontrolled dumping	(0)	
5.	Waste Spreading and Compacting		
a.	Refuse spread evenly and adequately compacted	(5)	5[d]
b.	Refuse spread, but not compacted	(2)	
c.	No spreading or compacting	(0)	
6.	Depth of Waste		
a.	If waste compacted in cells of 8 ft depth or less	(5)	5
b.	If waste compacted in cells less than 12 ft depth but more than 8 ft	(2)	
c.	If uncompacted or cells greater than 12 ft deep	(0)	
7.	Daily Earth Cover		
a.	If cover material is of good quality and is compacted in unbroken layers no less than 6 in. deep	(20)	
b.	If cover material is of poor quality, but is compacted well	(15)	
c.	If cover is not earth material (e.g., incinerator ash) but is greater than 6 in. thick	(10)	0
d.	No cover provided	(0)	
8.	Intermediate Cover		
a.	One foot or greater thick, good quality	(4)	
b.	One foot or greater thick, poorer quality	(3)	
c.	One foot or greater thick, not soil	(1)	
d.	No intermediate cover or, if so, poor application	(0)	
9.	Final Cover and Grading		
c.	Minimum depth - 2 ft good soil and grading	(8)	8
b.	Minimum depth - 2 ft poor soil and grading	(5)	
c.	No final cover, or poorly constructed and poorly graded	(0)	

TABLE G-9(Cont.)
LAND DISPOSAL EVALUATION SHEET

	Points Possible	St. Paul Site
10. Equipment Maintenance		
a. Maintenance facilities available on-site or standby equipment ready	(2)	
b. Routine maintenance equipment available, service arrangements made for major repairs	(1)	1
c. Nonexistent or inadequate maintenance facilities available	(0)	
11. Hazardous, Liquid and Bulky Waste Handling Provisions		
a. Procedures adopted for handling hazardous, liquid, and bulky products	(4)	
b. Hazardous and liquids excluded from site	(1)	1
c. Such materials accepted without special handling provisions	(0)	
12. Record Systems		
a. Complete daily records are maintained (e.g., type of waste, location of deposition, total weight, number of vehicles served)	(3)	3
b. Inadequate records are kept	(1)	
c. No records maintained	(0)	
Sub Total	(60)	32
III. ENVIRONMENTAL FACTORS		
1. Blowing Litter		
a. Fences or other barriers control blowing litter	(4)	
b. Some litter control exercised, but results are poor	(2)	2^e
c. No controls established	(0)	
2. Burning		
a. No burning allowed any time	(3)	3
b. Burning allowed	(0)	
3. Salvage		
a. No salvage at disposal site proper allowed	(3)	3
b. Controlled salvage practiced	(1)	
c. Scavenging allowed	(0)	
4. Vector Control		
a. Not practiced because unnecessary	(2)	2
b. Proper vector control supplied	(1)	
c. Vectors (rats, flies, etc.) present, but no control	(0)	

TABLE G-9(Cont.)
LAND DISPOSAL EVALUATION SHEET

	Points Possible	St. Paul Site
5. Dust Control		
a. Not required, or suitable control measures are supplied	(2)	2
b. Control provided, but inadequate	(1)	
c. Necessary, but not provided	(0)	
6. Placement of Solid Wastes in Groundwater		
a. Refuse placement above high groundwater mark	(5)	5
b. Intermittent contact possible	(3)	
c. Refuse deposited in water	(0)	
7. Surface Drainage		
a. Surface waters diverted from fill area; no ponding present	(6)	
b. Occasional water runs onto surface	(4)	4
c. No surface water control, cover scouring and erosion	(0)	
8. Animal Feeding		
a. No animal feeding allowed, fencing provided to prohibit animals	(2)	2
b. Animal feeding allowed	(0)	
Sub Total	(27)	23
Total	(100)	66 **

* Indicates points to be assigned if condition is met

** Score of 85 is rated acceptable by EPA
Score of 70-85 is rated marginally acceptable
Score of 55-70 is rated minimally acceptable
Score less than 55 is rated unacceptable

[a] First aid limited to kit in trailer.

[b] All weather access for trucks, not cars.

[c] Weighing facilities at baler.

[d] Bales compacted to greater density permitting greater cell depth.

[e] Litter control consists of periodically scraping work area. Not much blowing litter.